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THE UNIVERSITY OF ALBERTA

The Effect of Test Frequency and Feedback on Achievement and Retention in a Computer-Based Training Program

Ⓒ by

Susan D. Moisey

A THESIS
SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE
OF Doctor of Philosophy
Department of Educational Psychology

EDMONTON, ALBERTA
Spring 1988

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ISBN 0-315-42765-5

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DEGREE: Doctor of Philosophy

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled The Effect of Test Frequency and Feedback on Achievement and Retention in a Computer-Based Training Program submitted by Susan D. Moisey in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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ABSTRACT

This research project was conducted to investigate the effects of testing frequency and immediate or delayed feedback upon achievement and retention in a computer-based training program. Early in 1987, 171 members of a police department located in a major Canadian city volunteered to participate in this study. These volunteers were categorized according to years of experience in the police department and randomly assigned to one of eight treatment groups.

All subjects received training by taking a total of eight CAI modules in Criminal Law. Two feedback conditions and four conditions related to frequency of testing were used. In a testing situation, feedback was provided either immediately following the presentation of a test item or 24 hours later. Four variations of module tests were presented. A test was provided either after each module, after every second module, after every fourth module, or only after the last (eighth) module. In total, the same number of test items were presented to all subjects.

Prior to taking the eight CAI training modules, all subjects completed a pretest. A parallel achievement test was administered three days following the completion of the last training module. Ten weeks later, a retention test was administered.

Analysis of the pretest, achievement test, and retention test score means indicated no significant effects for test frequency or feedback delay. All groups had significantly higher achievement and retention test scores than pretest scores, however, there were no significant group differences. Analysis of means of the module test scores indicated a significant test frequency main effect. The more frequently tested groups had significantly higher module test scores than less frequently tested groups.

An analysis of the time which subjects spent on the training program indicated significant main effects for both testing frequency and feedback delay; more frequently tested groups spent less time studying the CAI modules than less frequently tested groups. Groups which received delayed feedback spent more time on tests than groups which received immediate feedback. On the basis of efficiency, it was concluded that testing after each individual module, coupled with immediate feedback, was the optimal training strategy.

ACKNOWLEDGEMENTS

I would like to thank the members of my thesis committee: Drs. Eugene Romaniuk, Craig Montgomerie, Steve Hunka, and Michael Szabo, as well as Dr. Paul Merrill who served as the external examiner. I am particularly grateful to Dr. Eugene Romaniuk, my thesis supervisor, for his guidance and support throughout this study; to Dr. Michael Szabo for his help in solving many logistic problems relating to the study; and to Dr. Steve Hunka for his assistance in research design and data analysis.

My special thanks are expressed to William Wosar who assisted with the data collection and to Hau Chow who helped with the data analysis. As well, I am grateful for the support of the Instructional Systems Group and the Division of Educational Research Services which provided computing facilities for this research project.

Finally, I acknowledge with special gratitude the faith and encouragement of my friends and especially my family: Larry, Matthew, and Benjamin.

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CHAPTER 1

THE PROBLEM

Introduction

Computer-based instruction presents unique challenges to educators. The attributes of computer-based instruction include interactivity, individualization, learner control, a range of instructional design strategies, alternate modalities (sound, text, graphics, and video), and flexible strategies for testing and feedback. These attributes create a potential for developing highly effective and efficient learning systems that meet the demands in many sectors for education and training.

Testing and feedback are particularly well suited and easily adapted to delivery by computer. Indeed, the field of computer-managed instruction (CMI) deals exclusively with the computer-controlled delivery of testing and feedback. The term, CMI, applies to the use of computer technology to monitor and manage events associated with learning such as presenting and scoring tests, recording and reporting test scores, determining student progress throughout a course, and directing the student to further or additional study. CMI differs from computer-assisted instruction (CAI) in that CMI generally does not provide the teaching component associated with the learning experience. In CAI, the computer acts as a teacher and a manager; in CMI, the computer acts only as a manager.

Baker (1981) identified four main functions of a CMI system:

1. Assessment -- The assessment function of CMI includes test item banking for the generation of examinations, marking of examinations, and item analysis.

2. Diagnosis and Prescription -- Based on a student's performance on a test or tests, a determination of learning level can be made and appropriate directions for further study prescribed. Based on performance, routing to more or less complex instruction can be made.

3. Record Keeping -- CMI monitors the performance of students, keeping track of their progress through the course.

4. Reporting -- Information is made available in the form of summarized reports or on an individual student basis.

By utilizing the testing and feedback capabilities of computer-assisted and computer-managed instruction, insight may be gained into the teaching and learning process. To date, much of the research on testing and feedback has occurred in regular classrooms or in laboratory-based settings. Very little research on feedback has been done within interactive, computer-based settings.

Testing and feedback are important elements of instruction. In a learning system, testing helps to indicate whether learning has occurred. Test feedback allows learners to gauge their performance and remediate their learning. All instructional design models incorporate, in some form or other, testing and feedback components. For example, Gagne and Briggs (1974) include "eliciting the performance" and "providing feedback" in their nine-event instructional model. Proposing a hypothesis and verifying the hypothesis are critical processes in the algo-heuristic theory of instruction (Landa, 1974). Component Display Theory (Merrill & Tennyson, 1977) includes two components, the inquisitory example (Ieg) and the inquisitory generality (Ig), to test conceptual learning, each followed by a respective feedback component.

The importance of testing and feedback in computer-based instruction has also been acknowledged. Hall (1983) noted with respect to testing that:

> Regardless of the approach selected by a courseware author, probably the single most important factor in producing courseware of a high educational quality is the nature of the questions which are presented to the learner. (p. 6)

The role of feedback in computer-based instruction has been receiving increasing attention. In particular, the type and timing of test feedback received in computer-assisted instruction has fallen under scrutiny (Cohen, 1985; Waldrop, Justen, & Adams, 1986; Viau & Clark, 1987; Kowitz & Smith, 1987; Jonassen & Hannum, 1987). In a series of articles discussing principles of CAI design, Jonassen and Hannum (1987) stated:

> Since courseware, like any other form of instruction is a communication process, feedback to the learner's responses are critical to learning . . . What type of feedback learners receive following responses in courseware is the first and most critical issue related to feedback in courseware. (pp. 7-8)

Several important instructional questions can be examined by exploring how best to use testing and feedback within an integrated interactive instructional system. For example, how frequently should students be tested? Typically students are tested at the end of a lesson or learning module. Is this the optimal testing frequency, however? Furthermore, in an interactive setting, does delaying feedback of test performance for up to 24 hours enhance retention? As the review of the research shows in

Chapter 2, delayed feedback appears to improve longer-term retention of knowledge in classroom-based studies. The results, however, are inconclusive in studies using computer-assisted instruction.

Background and Purpose of the Study

The efficacy and effectiveness of computer-based instruction, on the whole, is well established. In a meta-analysis of studies comparing college-based applications of CAI with other forms of instruction, Kulik, Kulik, and Cohen (1980) found that, overall, CAI compared favourably with other forms of instruction. They concluded that computer-assisted instruction made small, but significant, contributions to the achievement of college students and also produced positive, but again small, effects on the attitudes of students toward instruction and toward the subject matter they were studying. CAI also substantially reduced the amount of time needed for instruction. More recently, in a meta-analysis of secondary school applications of CAI, Bangart-Downs, Kulik, and Kulik (1985) concluded that overall, CAI increased performance, improved learner attitudes, and reduced instructional time. Kearsley (1984) acknowledged that the use of computers can significantly improve the efficiency and effectiveness of training, citing reductions in training time of 25 to 30 percent over other more conventional forms of training.

In an examination of computer-based training within a police force, Wosar and Szabo (1986) and Szabo (1988) reported net savings of $68,500 per year, as well as other benefits including increased use of specialized investigations and a higher pass rate on promotional examinations attributable to the use of computer-based training.

These findings are important. Training, in particular, requires cost effectiveness, achievement of competence (relevant skills and knowledge), and retention of competence over the long term. In an organization such as the police department, where issues of personal safety and the proper functioning of the legal system are critical, effective, efficient, and up-to-date training is mandatory. Minimizing time spent in training, including testing, and maximizing short-term achievement and longer-term retention of skills and knowledge are important goals.

Instructional methodologies which enhance the effectiveness and efficiency of training are required. Appropriate testing and feedback strategies play a major role in reaching such goals. Research in these areas is limited and narrow in scope, however. Studies on testing and feedback have occurred primarily within the educational sector. Most studies, particularly those involving CAI, have been undertaken at the university level (frequently in introductory psychology classes) with what may be termed the "traditional aged", 18 to 22 year old college student. A few studies have occurred at the junior and senior high school level. Research with the general adult population and the work-related training sector has been neglected.

Delineation of the Research Problem

In order to address the above concerns and limitations, this study was conducted using the computer-based training system of a police department located in a major Canadian City. The objectives were to explore the effects of testing and feedback upon the acquisition and retention of skills and knowledge. The study involved members of the police force who were engaged in on-the-job training and attempted to answer the following research questions:

1. Does frequency of testing affect achievement and retention of skills and knowledge? What is the relationship between how frequently trainees are tested and how well they develop skills and knowledge and are able to retain both over a period of time?

2. Does delayed versus immediate test feedback affect achievement and/or retention of skills and knowledge in an on-the-job training environment?

The following chapters will first review the literature relating to the topics of test frequency and delay of feedback; second, describe the research project that was conducted in order to answer the research questions stated above; and third, present the results and conclusions following from this study.

Definition of Terms

A list of terms pertinent to this study are defined below.

Computer-assisted instruction (CAI): the combination of computer programs and subject matter content in one of the following formats: tutorial, drill and practice, problem solving, simulation, gaming, and inquiry/retrieval (Rockart & Morton, 1975).

Computer-managed instruction (CMI): use of the computer to organize the learner's progress through a variety of instructional methods including print materials, audio and video tape materials, lectures, tests, and CAI (Godfrey and Sterling, 1982); the use of computers to assist in the management of instruction (Rockart & Morton, 1975).

Computer-based instruction: the use of the computer in education; includes CAI, CMI, as well as the computer as an object of study, e.g., computer science (Bork, 1981).

Computer-based training: the use of the computer in a learning environment where the learner is often a paid employee and where there is a greater emphasis on efficient mastery of objectives and comparisons of costs with traditional methods (Godfrey & Sterling, 1982); the use of computers in training systems, including testing, management, instruction, simulators, and embedded training (Kearsley, 1984).

Feedback: a procedure that tells if an instructional response is right or wrong (Kulhavy, 1977).

Immediate feedback: feedback received immediately following the initial exposure to the stimuli to be learned, generally involving a response selection on the part of the subject (Kulhavy, 1977).

Delayed feedback: feedback received following some specified interval (Kulhavy, 1977).

End-of-test (EOT) feedback: feedback on all items in a test which is received immediately after the completion of the last test item (Sturges, 1972).

By-item feedback: feedback received immediately after the response to each item on a test (Sturges, 1972).

Achievement: For the purposes of this study, achievement is defined as the score received on a test administered one to three days following the completion of the training program.

Retention: For the purposes of this study, retention is defined as the score received on a test administered 10 weeks following the completion of the training program.

Group Names: The eight treatment groups utilized in this study are denoted as follows:

IMM8: 8 tests, immediate feedback;
IMM4: 4 tests, immediate feedback;
IMM2: 2 tests, immediate feedback;
IMM1: 1 test, immediate feedback;
DEL8: 8 tests, 24-hour delayed feedback;
DEL4: 4 tests, 24-hour delayed feedback;
DEL2: 2 tests, 24-hour delayed feedback;
DEL1: 1 test, 24-hour delayed feedback.

City X Police Department (CXPD): The location in which the study took place.

CHAPTER 2

REVIEW OF THE LITERATURE

The following chapter reviews the research literature concerning the topics of frequency of testing and timing of feedback. Studies are presented in chronological order. The weaknesses of the research findings are discussed and a summary is provided at the end of each section.

Frequency of Testing

There is a dearth of research literature on the topics of testing frequency and the effect of testing frequency upon achievement and retention of skills and knowledge. In reviewing the relevant literature, the writer found only seven studies. None of the relevant studies found involved computer-managed or computer-assisted instruction.

Popham and Standlee (1960) studied the effects of frequent quizzes on student achievement in an introductory college-level educational psychology course. In the introduction to the text, the authors presented four reasons why frequent testing should enhance learning:

1. extrinsic motivation -- Students will work harder and more consistently throughout a course in order to get good grades on all tests.

2. diagnosis and remediation -- Frequent testing allows students to more easily identify their weaknesses and take measures to remediate them.

3. course structuring -- Frequent quizzes help to structure a course, helping students to determine which parts of the course are important. In other words, frequent tests may serve to substitute for explicitly stated instructional objectives.

4. active learning -- By participating in the test itself, students actively process content relating to the course.

Popham and Standlee used four classes (A-D) enrolled in an undergraduate psychology course to conduct their experiment (n = 35 in each group). Subjects in Group A were given weekly quizzes that were graded by the instructor and returned during the next class period. Group B received the same quizzes but these were graded by the students themselves during the same class period. Group C received a form of weekly quiz in which the instructor read a question and answered it, before reading the next question. Group D received no quizzes. Analyses of variance using the dependent variables of mid-term examination scores and final examination scores indicated no significant differences between treatment groups, however, Group A scored somewhat higher on the mid-term examination than the other three groups (p = .06).

Popham and Standlee concluded that the use of quizzes tended to increase students' mastery of subject matter early in a lecture-discussion type of course because of enforced activity with the subject matter, structuring of the course, knowledge of performance results, and extrinsic motivation provided by the quizzes; however, they concluded that any significant increase in achievement as a result of quizzes was lost by the end of the course.

Robinson (1972) investigated the effects of testing frequencies and whether the students' test scores counted or did not count toward determination of the final grade in a college-level introductory psychology course. In a 2 x 2 factorial design, four treatment groups were established: the first group received weekly tests that counted toward the final grade, the second group received weekly tests that did not count toward determination of the final grade, the third group received monthly tests that counted toward the final grade, and the fourth group received monthly tests that did not count toward determination of the final grade. Subjects receiving weekly tests received less instructional presentation time than subjects receiving monthly tests. Robinson reported that when scores on tests counted toward the final grade, scores on these tests were significantly higher than when tests did not count toward the final grade. However, no significant effect for frequency of testing was found in the analysis of final grades.

Palmer (1974) utilized three groups of college students in order to study the effects of three test schedules (six tests, three tests, and no tests during a semester) in an introductory psychology course (n = 84). Each group received the same instruction. Group 1, the six-test group, spent more time in testing than Group 2, the three-test group. Analysis of variance indicated a significant effect of test frequency ($F = 5.04$; $df = 2,81$; $p < .01$). Post hoc analysis indicated that groups 1 and 2 had non-significant differences in final examination scores. However, subjects in Group 3, the no-test group, had significantly lower examination scores than the other two groups. Palmer concluded:

> . . . While general mastery seemed unaffected by the frequency of testing, the fact that both tested groups performed significantly higher than the comparison group raises the possibility that periodic testing may have affected mastery. Regular assessment may be more important than frequency of regular assessment. (p. 422)

Shapiro and Stein (1974) investigated the effects of test frequency on community college students enrolled in a marketing course (n = 316). Based on each student's overall high school average, students were categorized into high-achieving (high school average greater than 75%) and low-achieving groups (75% high school average or less). Students in each group were then assigned to one of three test frequency conditions: 10 tests, 5 tests, or 3 tests over the term of the semester. Regardless of the frequency of testing, all students received a total of 150 multiple-choice test items. At the end of the semester, a final examination consisting of 100 multiple-choice test items was administered to each group. Shapiro and Stein concluded, based on the final examination scores, that low-achieving students in the 10-test group were able to achieve significantly higher final examination grades than low-achieving students who were tested less frequently. High-achieving students who received five tests had significantly higher final examination scores than the high-achieving students in the 10-test or 3-test groups. However, the nature of the statistical analysis conducted to arrive at these conclusions was not stated.

Negin (1980) investigated the effects of testing frequency in a first-year torts course in a university law school. Three groups were used in the study (n = 25 in each group). One group received three 1-hour, 75-item tests during the course plus a 3-hour, 225-item final examination. A second group received one 2-hour, 150-item test plus the same final examination as the first group. A third group received only the final examination. Each group was tested on the same content, however, the number of items and duration of testing differed among groups. The first group received a total of 450 items during six hours of testing; the second group received 375 items during five hours of testing; the third group received 225 items during a three hour test. In an analysis of variance of final examination test scores, significant differences were found among the groups ($F = 5.40$; $df = 1,72$; $p = .025$). Post hoc analysis indicated that the more frequently tested groups (groups 1 and 2) had significantly higher final examination scores than the one-test group. Negin concluded that first-year law students should be "tested more frequently than is currently the practice (i.e., one test). Frequent testing demystifies the study of law, humanizes the process, and improves the effectiveness of legal education" (p. 676).

Mayer and Rojas (1982) studied the effects of daily, weekly, and semi-monthly testing using three groups of students (n = 31 in each group) in a grade eight science course. On the last day of the 30-day experiment, a 30-item test was administered to all subjects. Analysis of variance of these test scores indicated no significant differences between groups.

Lindenberg (1984) studied the effects of testing frequency in a college-level accounting course taught at two colleges (n = 134). One class in each college was assigned to a frequent testing condition (12 tests), another class in each college was assigned to an infrequent testing condition (2 tests). Using the dependent variable of score on a CPA certification test, he concluded that no significant difference existed between the two groups.

Problems

Several studies reviewed failed to equate instructional time and resources among groups. As a result, more frequently tested subjects often spent more time in testing or were presented with more test items than less frequently tested subjects (Palmer, 1974; Negin, 1980). Similarly, subjects in the more frequently tested groups sometimes received less instructional presentation time, e.g., lecture hours, than less frequently tested subjects (Robinson, 1972).

In addition, in the studies reviewed, achievement alone was tested. Effects of frequent testing upon longer-term retention of achievement was not addressed.

All but one of the studies (Mayer & Rojas, 1982) used introductory college-level courses. Mayer and Rojas used an eighth grade science class and reported non-significant findings. A broader range of subjects and course content needs to be studied in order to further investigate the effects of frequent testing on achievement and retention.

Summary

Based on the studies reviewed, the relationship between test frequency and test performance is unclear. Of the seven studies reviewed, four failed to show statistically significant differences in achievement as a result of more frequent testing (Popham & Standlee, 1960; Robinson, 1972; Mayer & Rojas, 1982; Lindenberg, 1984). Two studies reported significant differences in achievement related to more frequent testing (Palmer, 1974; Negin, 1980). However, in these two studies, subjects in the more frequently tested groups spent more time in testing and were given more test items than the less frequently tested groups. Only in the Shapiro and Stein (1974) study were instructional time and resources equated across all groups.

Their results indicated that more frequent testing positively affected performance, and that score differences were largest for low-achieving students.

Timing of Feedback

Two schools of thought exist regarding the effect of testing and feedback within the learning process. The first school draws on an associationist or behaviorist paradigm which perceives the learner in the context of S-R models. Within this paradigm, feedback functions as a positive reinforcer designed to achieve a goal behavior, or approximation to a goal behavior, through successive approximations. As such, in order to be effective, feedback must immediately follow the behavior.

The second school of thought places testing and feedback within an information processing context. The learner is seen as an active processor of information. In this paradigm, it is proposed that more cognitive processing takes place, and enhanced retention of knowledge may result, when a time delay is imposed between the presentation of a question and its corresponding feedback. Various explanations for this phenomenon are presented in the review of the literature which follows.

For nearly three decades, the effect of delayed feedback on the retention of material has been studied. In the early 1960s, Brackbill and her associates (1962a, 1962b, 1964a, 1964b) discovered that delaying the presentation of feedback produced effects on the retention of information. They termed this phenomenon the Delay-Retention Effect (DRE) and studied it extensively.

Studies of the Delay-Retention Effect (DRE) have shown repeatedly that delaying feedback for a period of up to 24 hours results in enhanced retention of material (Sassenrath & Yonge, 1967, 1969; Sturges, 1969, 1978; More, 1969; Kulhavy & Anderson, 1972; Surber & Anderson, 1975; Joseph, 1985).

In an introductory psychology course, Sassenrath and Yonge (1967) used a 60-item multiple-choice test as the instructional treatment in order to contrast end-of-test feedback with 24-hour delayed feedback. A 60-item multiple-choice achievement test was administered immediately after feedback. Five days later, a retention test was administered. The retention test contained the same items as the achievement test, however, the test items had been reordered. Analysis of variance indicated no significant differences among achievement scores between the two feedback groups. Analysis of the retention test scores indicated a significant difference among the feedback groups (F = 5.06; df = 1,156; $p < .05$). The mean score of the delayed feedback group was significantly higher than that of the end-of-test feedback group.

Sassenrath and Yonge (1969) continued to study the effect of timing of the feedback delay. In this study, also conducted using a college level introductory psychology course, 311 subjects were randomly assigned to immediate (1 second delay) feedback after each item was answered or delayed (10 second delay) feedback after each item. An achievement test was administered at the end of the treatment and a retention test administered five days later. Analysis of variance of the achievement and retention test scores indicated no significant differences among achievement test scores. On the retention test, however, the 10-second delayed feedback group had significantly higher test scores than the 1-second delayed feedback group.

Sturges (1969) explored DRE as a means of improving long-term memory. In a laboratory setting, she used 35mm slides to present definitions of uncommon English words and corresponding test questions. Immediate by-item feedback, 24-hour delayed feedback, and no feedback conditions were contrasted. Using the dependent variable of the score on a test administered seven days after the laboratory experience, the mean group score for the delayed feedback group was significantly higher than the mean group scores for both the immediate and no feedback groups.

Phye and Baller (1970) attempted to replicate the Sturges (1969) study. Using 84 students in an undergraduate educational psychology course, they studied the effects of end-of-test feedback, 48-hour delayed feedback, and no feedback. Unlike Sturges, they used a classroom setting with group testing and aural feedback. An achievement test was administered immediately following instruction and a retention test was administered one week later. They reported a significant decrease in retention test scores, in comparison to achievement test scores, for all groups.

Sturges (1972) used a similar methodology to that of her 1969 study and examined the effect of three feedback conditions: by item, end of test, and 24-hour delay. Following instruction, an achievement test was administered in three modes: recall, recognition, and no test. Seven days later, retention was assessed, in both recall and recognition modes. As such, the design was composed of 18 groups (n = 10 in each group).

Analysis of achievement test scores indicated no significant differences for type of feedback. Analysis of the retention test scores indicated a significant effect for type of feedback. The 24-hour delayed feedback groups had significantly higher test scores in comparison to the immediate by-item feedback group. Analysis of a significant interaction between 24-hour delayed feedback and achievement testing mode indicated that recall test scores were higher in the delayed feedback groups than recognition test scores. Similarly, on the retention test, delayed feedback groups had significantly higher recall test scores than recognition test scores. The type of achievement testing also appeared to affect retention. The group which did not receive achievement testing scored significantly lower on the retention test. The group receiving the recognition achievement test had significantly higher retention test scores than the groups receiving the recall achievement test.

More (1969), in a classroom-based study using 663 students in grade eight social studies and science, examined the effect of four feedback delay conditions (immediate, 2.5 hours, 24 hours, and four days) on a retention test administered three days following test feedback. Groups receiving feedback delayed 2.5 hours and

24 hours had significantly higher achievement and retention test scores than groups receiving immediate feedback or feedback delayed four days.

Kulhavy and Anderson have conducted a number of studies of the delay-retention effect (e.g., Anderson, Kulhavy, & Andre, 1971, 1972; Kulhavy & Anderson, 1972; Surber & Anderson, 1975; Kulhavy, 1977). To explain the DRE phenomenon, Kulhavy and Anderson (1972) proposed the interference-perseveration hypothesis:

> According to the interference-perseveration hypothesis, when a person makes an error on the first test, he strengthens an A-B connection which then interferes with acquiring an A-C connection from the feedback. Proactive interference is greatest when stimuli in successive tasks are identical and the responses are dissimilar. This, it is argued, is the condition that prevails when an incorrect response is made on the first test. According to this analysis, a person who makes a correct response choice on the first test places himself in the A-C A-C paradigm, a condition known to facilitate retention. (p. 507)

In other words, delayed feedback allows an incorrect association (A-B) to weaken between the time the error was made and the time when the feedback was received. This allows the later, correct connection (A-C), based on feedback, to occur. Original correct associations are strengthened at the time of feedback and do not show a decrement in strength.

Kulhavy and Anderson (1972) investigated DRE by using 194 junior and senior high school students. A 35-item multiple-choice test on introductory psychology was presented and immediate and 24-hour delayed feedback conditions were contrasted. A retention test was administered one week following the first test. Analysis of variance indicated that students in the 24-hour delayed feedback groups had significantly higher scores on both the achievement and retention tests in comparison to the immediate feedback group. In addition, it was found that subjects spent more time studying the feedback when it was presented 24 hours after the test than they did when the feedback was presented immediately after the test. Kulhavy and Anderson attributed this time difference to testing fatigue and added that delayed feedback allowed the learner to process the feedback information more carefully than when the feedback was presented immediately. In conclusion, they acknowledged three interacting factors in the DRE phenomenon: (a) the tendency for a second test, i.e., a retention test, to strengthen responses; (b) forgetting original responses due to the delay; and (c)

> error tendencies interfere with learning correct responses from the feedback when it is presented immediately following the incorrect response (p. 511).

To explain the feedback study-time data, they introduced an alternative explanatory hypothesis based on attention. Subjects in the delayed feedback group spent more time studying the feedback than subjects receiving immediate feedback. Based on an analysis of covariance, they reported that "while nearly two-thirds of the delayed feedback variance was attributable to interference-perseveration, more than one-third was attributable to increased study time." (p. 551). Kulhavy and Anderson concluded that attention was a secondary factor to the interference-perseveration hypothesis in explaining the delay-retention effect.

Newman, Williams, and Hiller (1974) studied the effects of immediate, 24-hour delay, seven-day delay, and no feedback on recall of an assigned reading in an undergraduate educational psychology course (n = 78). Seven days following feedback, a retention test was administered. No significant differences were reported.

Surber and Anderson (1975) used 144 high school students in a classroom setting and investigated the effects of immediate feedback, 24-hour delayed feedback, and no feedback on a retention test of reading recall.

They found that test feedback (immediate and 24-hour delayed) was significantly better than no test feedback, and that 24-hour delayed feedback was significantly better than immediate feedback in enhancing retention of learned material.

Kulhavy (1977), in a review of the literature on feedback processes, concluded that feedback is not facilitative when it is too readily available (i.e., occurs prior to, simultaneously with, or too soon after the presentation of the test or test item), and when the information is so complex that students fail to comprehend it. In his review of the studies of DRE, Kulhavy noted the consistency with which numerous studies supported the phenomenon.

Sturges (1978) confirmed the delay-retention effect using computer assisted testing methodology. She hypothesized that students who received information about the correct answer under a delayed feedback paradigm, tended to process the information during the delay and thus show better retention. In order to investigate this hypothesis, she compared immediate by-item feedback, end-of-test feedback, 24-hour delayed feedback, and no feedback upon the performance of 112 students in a college-level developmental psychology course. An interactive, computer-based achievement test was administered after instruction and a paper-and-pencil retention test was administered one to three weeks later. She reported that the groups receiving end-of-test feedback and 24-hour delayed feedback had higher retention test scores than the groups receiving immediate feedback or no feedback.

Using a CAI-based graduate level statistics course (n = 60), Sheridan (1980) contrasted two feedback conditions: immediate by-item feedback and 24-hour delayed feedback. Based on scores on a retention test administered seven days after a CAI module on "t-tests" was completed, he reported no significant differences between the immediate and delayed feedback groups. This study is noteworthy, however, because it utilized an integrated interactive system wherein both instruction and testing were conducted via computer-based technology.

Gaynor (1981) investigated the effect of immediate feedback, 30-second delayed feedback, end-of-test feedback, and no feedback on short- and long-term retention of skills in four CAI lessons of an undergraduate business statistics course. Short-term retention was assessed using a test administered at the end of the modules; long-term retention was assessed 14 days later. Each test contained the same number and type of items, however, it was not indicated whether the two posttests were parallel. The sample of 92 students were separated into high and low mastery groups based on an assessment of their mathematical competency. Each subject was then randomly assigned to one of four feedback conditions. Analysis of the posttest scores indicated no significant differences among the immediate, end-of-test, and no feedback conditions for either mastery group. She reported that 30-second delayed feedback showed detrimental, but statistically non-significant, effects for both mastery groups.

Joseph (1985) used a classroom-based fifth grade mathematics course to study the effect of three feedback conditions: by-item, end-of-test, and 24-hour delay. A total of 360 subjects were utilized in the study. Using the dependent variable of score on an achievement test administered one day after instruction, he concluded that the most effective feedback condition was immediate by-item feedback. When the dependent variable was retention, as measured by a test conducted seven days after the presentation of the achievement test, the 24-hour delayed feedback group performed best.

Problems

Several problems exist in the research on the Delay-Retention Effect. First, the definition of delayed feedback is inconsistent among studies. Delayed feedback involves imposing a time interval between the test item and corresponding feedback. In the studies reviewed, the time interval ranged from 10 seconds (Sassenrath & Yonge, 1969) through seven days (Newman, Williams, & Hiller, 1974). From an information processing standpoint, it might be argued that a short delay, e.g., 10 seconds, is indeed immediate feedback.

Similarly, the definition of retention is variable and the time interval over which retention is measured is somewhat abbreviated. In the studies reviewed, retention ranged from three days (More, 1969) to three weeks (Sturges, 1978). A delay of seven days was most commonly used to measure retention. None of the studies reviewed measured retention beyond a period of three weeks.

Another problem relating to the DRE literature lies in the presentation of the content on which subjects were tested. In the studies reviewed, the instruction which subjects received prior to testing was highly variable. The instructional presentation included no prior instruction, classroom based lecture and discussion, an assigned reading, a workbook lesson, and a CAI module.

Furthermore, for the most part, no effort was made to assess the effectiveness of the instruction itself or to optimize the instructional quality of the material.

A final problem noted in the literature review lies with the nature of the feedback itself. Across the studies, there is little similarity among the types of feedback provided after the presentation of a question. Test feedback included class discussion of questions, individualized aural feedback, individualized written feedback, and computer-generated written feedback. As a result, comparisons among studies is difficult and may be invalid.

Summary

In spite of the problems noted above, DRE appears to be a well documented phenomenon. Only four of the studies reviewed (Phye & Valler, 1970; Newman, Hiller, & Williams, 1974; Sheridan, 1980; and Gaynor, 1981) failed to support the hypothesis that delayed test feedback enhances retention. Two of these studies (Phye & Valler, 1970; Newman, Hiller, & Williams, 1974) did not appear to use optimized instruction or did not provide effective forms of testing and feedback. In Sheridan's (1980) study, small cell sizes may have negated any significant findings. In the Gaynor (1981) study, the length of the delay may not have been extensive enough to elicit the DRE phenomenon; the longest delay imposed was end-of-test feedback.

CHAPTER 3

PROCEDURES AND METHODOLOGY

Overview

This study investigated the effects of frequency of testing and immediate or delayed feedback upon achievement and retention of knowledge. The following research questions were addressed:

Research Question #1: Does more frequent testing improve achievement and retention? What is the relationship between frequency of testing during training, and achievement and retention?

The null hypotheses for this research question are as follows:

H_o: There is no difference in mean achievement test scores between the various test frequency groups.

H_o: There is no difference in mean retention test scores between the various test frequency groups.

Research Question #2: Does immediate test feedback produce higher achievement test scores than test feedback delayed 24 hours? Does 24-hour delayed feedback produce higher retention test scores than immediate feedback?

The null hypotheses for this research question are as follows:

H_o: There is no difference in mean achievement test scores between immediate and delayed feedback groups.

H_o: There is no difference in mean retention test scores between immediate and delayed feedback groups.

In order to explore these questions and hypotheses, a study was conducted using a modularized computer-based training program to present various testing and feedback strategies. The effects of these strategies on achievement and retention test scores were studied. The methodology of this project is described in the sections that follow.

Research Design

The research design used in this study is a variation of the one-group pretest-posttest design identified by Campbell and Stanley (1963). This design has several inherent weaknesses, particularly history and maturation (Campbell and Stanley, 1963, p. 5). In order to compensate for these weaknesses, the following measures were taken: (a) more than one posttest was used; (b) eight treatment groups were used; (c) subjects were randomly assigned to groups; and (d) groups were matched according to a variable assumed to reflect experience.

The research design can be depicted as follows:

$$O_1 - X - O_2 - O_3$$

To elaborate, a pretest (O_1) was followed by a particular treatment (X), which in turn was followed by two posttest measures (O_2 and O_3).

All subjects were pretested at O_1 and randomly assigned to one of eight variations of a training program (X). Shortly following the completion of the training program, at O_2, an achievement test was administered. Following a delay of approximately 10 weeks, at O_3, a retention test was administered. Figure 1 illustrates the design of the study.

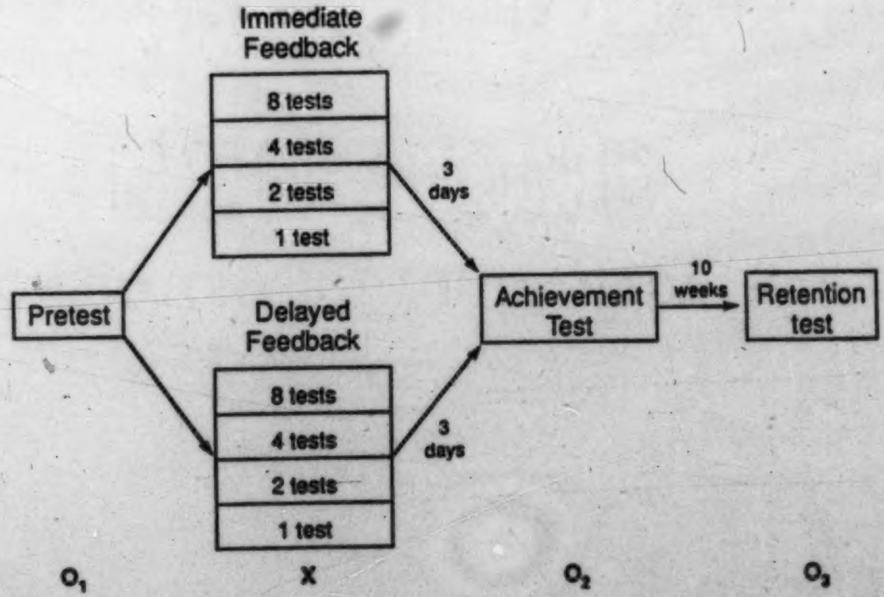
Immediate Feedback
8 tests
4 tests
2 tests
1 test
3 days
Pretest
Delayed Feedback
8 tests
4 tests
2 tests
1 test
3 days
Achievement Test
10 weeks
Retention test
O₁
X
O₂
O₃

Figure 1. Research Design

The Treatment

The training program used in this study consisted of eight Criminal Law modules presented in the following sequence: Arrest Review 1987, Search Review 1987, Appearance Notices, Laws of Evidence, Elements of Crime, Public Order Offences, Operate While Impaired, and Criminal Vehicle Offences. Each module was independent, i.e., no module was prerequisite to a following module.

The eight modules had been developed using the OMNISIM[1] authoring system by the Training Section of the City X Police Department (CXPD) for use on the PLATO system. Each module had previously been subjected to extensive pilot and field testing. The performance objectives for the eight modules are included in Appendix A.

The modules were delivered to the subjects via PLATO terminals connected to a commercial PLATO service mainframe computer. Three terminals were located at CXPD headquarters and one terminal in each of three remote detachment sites. During the project, additional terminals were made available to the subjects at the commercial PLATO service centre.

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[1] OMNISIM is an authoring system developed at the University of Alberta (Instructional Systems Group, 1986).

Eight testing strategies were developed using Plato Learner Management (PLM) software[1]. The strategies were used to investigate the effects of testing frequency and feedback. The testing strategies followed a 4 x 2 factorial design.

Frequency of testing (independent variable A) had four levels:

A_1 testing after each module (i.e., a total of 8 tests);

A_2 testing after every second module (4 tests);

A_3 testing after every fourth module (2 tests); and

A_4 testing after the last module (1 test).

Delay of test feedback (independent variable B) had two levels: B_1, no delay (immediate, by-item feedback) and B_2, 24-hour delayed, by-item feedback. Thus a total of eight treatment groups were identified as indicated in Table 1.

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[1] PLATO Learner Management (PLM) is a software package for a computer-managed instruction (Control Data, 1982).

Table 1. Group Identification

		Factor A			
		A_1	A_2	A_3	A_4
		(8 tests)	(4 tests)	(2 tests)	(1 test)
Factor B	B_1 (Immediate Feedback)	IMM8	IMM4	IMM2	IMM1
	B_2 (Delayed Feedback)	DEL8	DEL4	DEL2	DEL1

Subjects

There are approximately 1,100 members in the City X Police Department (CXPD). On-going staff training is provided using a series of PLATO modules in topic areas such as criminal law, investigation procedures, and court proceedings. Typically, members of the police force are required to master one module of instruction per month in order to meet their contractual agreement. Mastery of a module is indicated by a passing grade of 80% on the module test. Module tests may be retaken until the 80% criterion is reached. Monthly directives are issued requesting members to complete a specified module when an important change in law has occurred or when a new module becomes available; otherwise, members may choose from a selection of nearly 50 modules that are available for staff training.

In January, 1987, a letter was sent to all members of the CXPD inviting them to participate in a study on testing in computer-based training; 171 police force members volunteered to participate in the study. To control for differences in the number of years of employment as police members, the subjects were categorized according to number of years of employment with the CXPD. Six categories were identified: 0 years (recruits); 1 year; 2-5 years; 6-10 years; 11-15 years; and 16+ years. Subjects within each category were randomly assigned to one of the eight treatment groups. As Tables 2 and 3 show, each group was approximately equal in size and composition.

Table 2. Number of Subjects in Each Group

	Number of Tests				
Test Feedback	8	4	2	1	Total
Immediate	21	21	22	22	86
Delayed	22	21	21	21	85
Total	43	42	43	43	171

Table 3. Subjects Categorized by Years of CXPD Employment

Treatment Group	Years of Experience						Total
	0	1	2-5	6-10	11-15	16+	
IMM8	3	3	2	5	4	4	21
IMM4	3	3	3	5	4	3	21
IMM2	3	3	3	6	4	3	22
IMM1	3	3	3	5	4	4	22
DEL8	3	3	3	5	4	4	22
DEL4	4	3	3	4	4	3	21
DEL2	3	3	3	5	4	3	21
DEL1	4	3	3	4	4	3	21
Total	26	24	23	39	32	27	171

Procedures

Instructions to Subjects

In an introductory letter (Appendix B), subjects were assigned individual PLATO group signon IDs. The IDs indicated the group to which each subject had been assigned. Subjects were instructed to use their assigned signon IDs throughout the training program. Subjects were oriented to the training program (X), the pretest (O_1) and posttests (O_2 and O_3) were introduced, and the title of each module to be completed was presented. Subjects were informed that the training program would continue for 16 weeks and asked to indicate any scheduling problems that might arise.

All subjects were instructed to complete one module and a corresponding test, if appropriate, every two weeks. In the introductory letter, deadlines were given, which reflected the end of each two-week period. Subjects were told to complete all tests without the aid of books, notes, or other instructional resources. Subjects in the delayed feedback groups were instructed to report to the Training Section office the day after completion of a module test (24 hours later) in order to receive their feedback.

Reminder notices were issued at the end of each two-week period to inform subjects of the next module and, if necessary, the name of the module test to be completed.

After completing the achievement test (O_2), subjects were notified by letter and given a date for taking their retention test (O_3).

Testing Procedures

During the 16-week training program, testing occurred in four variations: eight tests, four tests, two tests, and one test. Table 4 illustrates the modules after which tests were administered. An "X" indicates that a test was administered upon completion of the corresponding module.

Table 4. Test Administration

	Groups			
	IMM8 DEL8	IMM4 DEL4	IMM2 DEL2	IMM1 DEL1
Pretest	X	X	X	X
Module Tests:				
Arrest Review	X			
Search Review	X	X		
Appearance Notices	X			
Laws of Evidence	X	X	X	
Elements of Crime	X			
Public Order Offences	X	X		
Operate While Impaired	X			
Criminal Vehicle Offences	X	X	X	X
Achievement Test	X	X	X	X
Retention Test	X	X	X	X

As Table 4 illustrates, all participants completed a pretest. This test was composed of 52 multiple-choice items, two items for each performance objective of the training program. The pretest was administered on-line, prior to beginning the first training module.

Following the pretest, each subject completed eight CAI modules over a 16-week period. The module tests were completed as illustrated in Table 4. For the purposes of this study, subjects were not required to master the module test, i.e., achieve a score of 80% or more. Subjects were required to complete the module test once, and that score was recorded as their module test score.

Subjects in groups IMM8 and DEL8 completed a test after each module (eight module tests). Subjects in treatment groups IMM4 and DEL4 completed a test after every second module (four module tests). Subjects in treatment groups IMM2 and DEL2 completed a test after every fourth module (two module tests). Subjects in treatment groups IMM1 and DEL1 wrote only one module test, i.e., at the end of the training program. Although the module tests were administered in different frequencies, and hence had different lengths, all subjects completed a total of 104 module test items (four items for each performance objective of the training program).

Within three days of receiving feedback on the items in the final module test as described above, all subjects completed an on-line achievement test (O_2) consisting of 52 multiple-choice items (two items for each performance objective of the training program).

Ten weeks later, a retention test (O_3) was administered to all subjects. This on-line test contained the same 52 multiple-choice items as in the achievement test, however, the items and the distractors had been reordered. Thus, the achievement and retention tests were regarded to be parallel forms of the pretest.

All subjects received the same total number of test items, that is, the total number of test items remained constant across all treatment groups. Table 5 summarizes the number of test items in each of the tests for the eight treatment groups.

Table 5. Number of Test Items

	Groups			
	IMM8 DEL8	IMM4 DEL4	IMM2 DEL2	IMM1 DEL1
Module Tests[a]:				
Arrest Review 1987	12			
Search Review 1987	12	24		
Appearance Notices	12			
Laws of Evidence	12	24	48	
Elements of Crime	16			
Public Order Offences	12	28		
Operate While Impaired	16			
Criminal Vehicle Offences	12	28	56	104
Total # of Module Test Items	104	104	104	104
Pretest[b]	52	52	52	52
Achievement Test	52	52	52	52
Retention Test	52	52	52	52
Total # of Items	260	260	260	260

[a] Module tests consisted of four items for each performance objective of the training program.

[b] The pretest, achievement test, and retention test each consisted of two items for each performance objective of the training program.

As Table 5 indicates, all subjects completed a total of 104 module test items. The allotment of the 104 items was reflected by the test frequency condition. The 8-test groups completed eight short module tests (12-16 items each); the 4-test groups completed four module tests consisting of 24, 24, 28, and 28 items, respectively; the 2-test groups completed two module tests, one consisting of 48 test items and the other 56; and the 1-test groups took one 104-item module test at the conclusion of the training program.

Feedback Procedures

Within each testing group, the subjects received either immediate feedback on each item or 24-hour delayed feedback.

Immediate feedback occurred on-line, following presentation of each test item and the student´s response. The feedback was presented on the same screen display as the item, and indicated whether the student´s response was correct or incorrect, and, if the student´s response was incorrect, provided the correct answer. There was no time limit on how long subjects could study the feedback. If they required further clarification of a question, subjects were able to use the TERM-COMMENT facility on the PLATO system in order to receive additional information from Training Section personnel.

After completing a module test, subjects who received delayed feedback were told to report to the Training

Section office the next day (24 hours later). If subjects failed to appear at that time, they were telephoned or contacted in person and were given their test feedback. Nevertheless, the Training Section personnel and the subjects involved in this study endeavoured to give and receive test feedback 24 hours following completion of the module test(s).

When receiving the feedback, each subject was presented with a complete list of the items which were on the module test, the subject's response to each item, whether the subject's response was correct/incorrect, and the correct answer, if the response was incorrect. The subjects were allowed to spend as much time as they wished studying the feedback and were allowed to ask for clarification from Training Section personnel.

Instrumentation

The study was conducted using a pretest, followed by the instructional treatment, followed by two posttest measures: an achievement test and a retention test. An attitudinal questionnaire was administered after the treatment. The questionnaire and each test is described below. Copies of all instruments appear in Appendix C.

Test Development

In order to create the pretest and posttest measures, the writer assessed the performance objectives of the training program and determined the cognitive level, conditions, and performance standards of each one. For each performance objective, four test items were then selected from a test item bank or created if none were appropriate.

Content validity was established by matching test items, in pairs, by content, cognitive level, and technical characteristics such as similarity of stems and equal number of distractors. One item of each matched pair was randomly assigned to the pretest, the other to the posttest. As a result, two (52-item) on-line tests were created.

In order to determine if the tests were parallel forms, both tests were administered to nine members of the police department who would not be involved in the research study. Both tests were taken in one sitting. In order to avoid differences due to test fatigue, half of the subjects completed the pretest then the posttest, the other half took the posttest first followed by the pretest. Table 6 reports the mean scores and standard deviations for the pretest and posttest. Scores are reported in raw form representing the number of items correct out of 52.

Table 6. Pretest and Posttest Means and Standard Deviations

	Pretest	Posttest
Mean	34.11	31.44
Standard Deviation	5.11	6.37

n = 9

A t-test for dependent samples was used to determine whether the pretest and posttest score means were different at the .05 level of significance; the observed t-score was not significant (t = 1.57, df = 8, p = .16). As a result, it was concluded that the means of the two tests were similar.

The Pearson Product Moment correlation[1] between the tests was r = .66. The internal consistency for each test was satisfactory (Cronbach alpha = .65 and .79 for the pretest and posttest, respectively). The Spearman-Brown coefficient was .79. Although the correlation between the tests was not high (i.e., approximately 44 percent of the variance accounted for), the result added credibility to the assumption that the tests were parallel forms of each other.

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[1] The SPSSX subroutine Reliability-Split Model was used to determine the correlation between the tests.

The posttest was used as both the achievement test and retention test. All subjects completed the achievement test within three days of finishing the training program. The retention test was composed of the same items as the achievement test, however, the items and distractors had been rearranged.

Questionnaire

In order to determine whether subjects were satisfied with their training experiences and to identify any problems that they may have experienced, a questionnaire was developed to assess subjects' attitudes toward various aspects of the training program. The questionnaire was validated by using five CXPD members who were not involved in the study. The questionnaire was administered following completion of the training program. Subjects returned the questionnaires, by mail, to the Training Section. In order to assure anonymity, group identification appeared on the questionnaire and subjects were asked not to reveal their names or ranks.

Module Tests

Depending on the testing group to which they had been assigned, subjects completed eight, four, two or one module test(s). Module tests, plus the CAI modules, composed the instructional treatment. The on-line module tests were developed and integrated according to the conditions of each testing group. Each module test was composed of four items per performance objective of the module(s) covered. Total number of items appearing on each module test are listed in Table 5.

Delimitations of the Study

In order to establish controls for experimental purposes, certain restrictions were placed on the training program. The mastery-based model, typically used by the CXPD training program, was replaced with a non-mastery-based training model. Subjects completed only one form of each module test, their test score was recorded, and they were allowed to proceed to the following module regardless of the score they received on the module test. As a result, the study should not be regarded as indicative of a mastery-based or competency-based training program.

Data Collection and Recording

The following data were collected for each participant in the study:

1. Years of employment with the City X Police Department;
2. Pretest score;
3. Achievement test score;
4. Retention test score;
5. Total score for module test(s);
6. Total time spent on-line completing the eight CAI modules;
7. Total time spent on-line completing the module test(s);
8. Responses on a post hoc questionnaire designed to measure attitudes toward various aspects of the training program.

The results of the study are presented in the following chapter.

CHAPTER 4

RESULTS AND DISCUSSION

Introduction

The sections which follow describe the findings of the study. The sample is described and the research questions and hypotheses are investigated using analysis of variance and correlational techniques. An analysis of the questionnaires concludes the chapter.

The Sample

Early in 1987, 171 members of the City X Police Department (CXPD) volunteered to participate in the study. Before assignment to treatment groups, these subjects were categorized according to the number of years of employment by the CXPD. The following categories were identified: 0 years experience (recruits); 1 year; 2-6 years; 6-10 years; 10-15 years; and 16+ years. Subjects within each category were then randomly assigned to one of eight treatment groups.

During the four-month period of the training program, attrition occurred due to transfers, work assignments, and failure of some subjects to meet the training schedule. A total of 145 subjects (85%) completed the training program, the achievement test, and the retention test; 26 subjects (15%) failed to complete the training program. Table 7 shows the total number of subjects remaining in each group. Table 8 shows the composition of each group, based on years of employment with the City X Police Department.

Table 7. Subjects Completing the Training Program, Achievement Test, and Retention Test

	Number of Tests				
Type of Feedback	8	4	2	1	Total
Immediate	21	18	19	21	79
Delayed	16	18	16	16	66
Total	37	36	35	37	145

Table 8. Subjects Completing the Training Program, Categorized by Years of CXPD Employment

Treatment Group	Years of Experience 0	1	2-5	6-10	11-15	16+	Total
IMM8	3	3	2	5	4	4	21
IMM4	3	3	3	4	2	3	18
IMM2	3	3	3	6	3	1	19
IMM1	3	3	3	5	3	4	21
DEL8	3	3	2	3	2	3	16
DEL4	4	3	2	4	3	2	18
DEL2	3	2	2	5	2	2	16
DEL1	4	3	1	4	3	1	16
Total	26	23	18	36	22	20	145

Analysis of Pretest, Achievement Test, and Retention Test Scores

The first set of analyses was conducted to determine whether feedback delay and/or testing frequency were contributing factors toward achievement and retention test scores. The mean scores for the pretest, achievement test, and retention test for the eight treatment groups are listed in Table 9. Means are reported in raw score form, representing the number of items correct out of 52. The group standard deviation scores appear in parentheses beneath each mean.

Table 9. Means and Standard Deviations for the Three Tests[a]

Treatment Group	n	Type of Test Pretest	Achievement Test	Retention Test
IMM8	21	33.52 (5.59)	35.71 (4.31)	36.33 (4.26)
IMM4	18	33.78 (6.69)	37.94 (6.55)	38.06 (5.70)
IMM2	19	31.68 (5.37)	36.53 (6.60)	35.68 (5.57)
IMM1	21	33.14 (4.83)	37.24 (4.32)	35.90 (5.16)
DEL8	16	34.69 (6.43)	38.13 (5.67)	37.38 (4.72)
DEL4	18	32.78 (7.02)	35.89 (4.55)	35.00 (5.72)
DEL2	16	34.12 (6.29)	36.13 (5.84)	35.19 (4.32)
DEL1	16	32.44 (6.16)	35.31 (5.15)	35.56 (5.23)
Total	145	33.24 (5.98)	36.61 (5.36)	36.14 (5.09)

[a] Means are in raw score form indicating the number of correct items out of 52.

As Table 9 shows, the groups appeared to be homogeneous with regard to their entry level skills, as reflected in the areas tested by the pretest. Mean pretest scores ranged from a low of 31.68 (60.9%) for the 2-test, immediate feedback group (IMM2) to a high of 34.69 (66.7%) for the eight-test, delayed feedback group (DEL8). The mean pretest score for the total sample was 33.24 (63.9%).

Achievement test score means ranged from 35.31 (67.9%) to 38.13 (73.3%) for the eight treatment groups. The mean achievement test score for the total sample was 36.61 (70.4%). All groups had higher achievement test scores than pretest scores. There was a net gain of 3.37 points (6.5%) between the pretest and the achievement test means (Table 10).

Retention test score means ranged from 35.00 (67.3%) to 38.06 (73.2%) for the eight treatment groups. The mean retention test score for the total sample was 36.14 (69.5%). Three groups, IMM8, IMM4, and DEL1, performed better on the retention test than on the achievement test. Overall, there was a mean net loss of 0.47 points (0.9%) between the achievement test and the retention test means (Table 10).

Difference scores between the pretest and achievement test, and the achievement test and the retention test are reported in Table 10.

Table 10. Mean Difference Scores[a]

Group	n	Pretest/ Achievement Test Net Change	Achievement Test/ Retention Test Net Change
IMM8	21	+2.19	+0.62
IMM4	18	+4.16	+0.12
IMM2	19	+[illegible].85	-0.85
IMM1	21	+4.10	-1.34
DEL8	16	+3.44	-0.75
DEL4	18	+3.11	-0.89
DEL2	16	+2.01	-0.94
DEL1	16	+2.87	+0.25
Total	145	+3.37	-0.47

[a] Difference scores are reported in raw score form representing total gain or loss out of 52 points.

A 2 x 4 x 3 analysis of variance[1], with repeated measures on Factor C (pretest, achievement test, retention test), was conducted on the test scores. The results are presented in Table 11.

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[1] The SPSSX procedure ANOVAR was used to conduct all analyses of variance.

Table 11. Analysis of Variance of Test Scores[a]

Source	SS	DF	MS	F	P
Between Subjects					
A (FB)	6.43	1	6.44	.09	.762
B (TEST FREQ)	86.93	3	28.98	.41	.744
AB	202.21	3	67.40	.96	.413
Within Cells	9615.00	137	70.18		
Within Subjects					
C (T,RET)	936.70	2	468.35	42.63	.001*
AC	28.56	2	14.28	1.30	.274
BC	12.18	6	2.03	0.18	.981
ABC	62.92	6	10.49	0.95	.457
Within Cells	3010.63	274	10.99		

[a] Pretest, achievement test, and retention test scores were analyzed.
$n = 145$
*significant at $p < 0.05$

A significant main effect ($F = 42.63$; $df = 2,274$; $p < .05$) was found for the repeated measure, Factor C (pretest, achievement test, retention test). No other significant effects were detected.

A second set of analyses of variance was conducted after the data for the recruits were removed from the analysis (n = 119). It was felt that the recruits may have been dissimilar from the other subjects because of their different backgrounds prior to the training program and their experience over the duration of the training program. Unlike the rest of the sample, the recruits had no prior experience in police work. It was thought that their pretest scores may be lower than those of the other subjects who had greater entry level knowledge. These differences will be discussed in a later section which examines differences among the various categories of length of CXPD employment. Furthermore, over the course of the training program used in this study, recruits were also involved in recruit training. As a result, their gains in knowledge between the time of the pretest and the time of the achievement and retention tests may have been greater than those of the other subjects.

Table 12 lists the mean scores for the pretest, achievement test, and retention test for the sub-sample with the data for the recruits excluded.

Table 12. Test Score Means[a] and Standard Deviations (With Recruits Excluded)

Treatment Group	n	Pretest	Achievement Test	Retention Test
IMM8	18	34.50 (5.65)	36.11 (4.50)	36.61 (4.05)
IMM4	15	34.40 (7.06)	38.00 (7.09)	38.33 (6.18)
IMM2	16	33.19 (4.35)	36.75 (7.08)	36.13 (5.99)
IMM1	18	33.67 (4.90)	37.17 (4.09)	35.94 (5.54)
DEL8	13	36.38 (5.71)	38.47 (6.05)	37.85 (4.60)
DEL4	14	34.57 (5.69)	36.07 (4.30)	34.86 (5.91)
DEL2	13	35.61 (5.38)	37.39 (4.91)	35.54 (4.35)
DEL1	12	34.17 (6.21)	36.83 (4.86)	36.17 (5.73)
Total	119	34.49 (5.54)	37.06 (5.36)	36.43 (5.29)

Type of Test: Pretest, Achievement Test, Retention Test

[a] Means are in raw score form indicating total score out of a possible 52 points.

Once the data for the recruits were excluded, mean pretest scores ranged from 33.19 (63.8%) to 36.38 (70.0%); the overall mean for the sub-sample was 34.49 (66.3%). As assumed, the pretest mean scores were larger across all groups once the pretest scores for the recruits were removed.

Similarly, achievement test score means and retention test score means were also larger. Achievement test scores ranged from 36.07 (69.4%) to 38.47 (74.0%), with an overall mean of 37.06 (71.3%). The net gain between the pretest and achievement test scores was less, however, in comparison to that of the total sample. There was a net gain of 2.57 points (4.9%) between the pretest and achievement test scores of the sub-sample with the recruits excluded, as opposed to a gain of 3.37 (6.4%) with the recruits included.

Retention test scores for the sub-sample ranged from 34.86 (67.0%) to 38.33 (73.7%), with an overall mean of 36.43 (70.1%). Two groups, the 8-test immediate feedback group (IMM8) and the 4-test immediate feedback group (IMM4), had higher test score means on the retention test than on the achievement test. There was a net loss of 0.63 points (1.2%) between the achievement test and the retention test score means for the sub-sample with the recruits excluded. This net loss was much the same as that for the sample with the recruits included (-0.47 points or 0.9%).

Difference scores between the means of the pretest and achievement test, and the achievement test and the retention test, for the sub-sample with the recruits excluded are reported in Table 13.

Table 13. Mean Difference Scores[a] (Recruits Excluded)

Group	n	Pretest/ Achievement Test Net Change	Achievement Test/ Retention Test Net Change
IMM8	18	+1.61	+0.50
IMM4	15	+3.60	+0.33
IMM2	16	+3.56	-0.62
IMM1	18	+3.50	-1.23
DEL8	13	+2.09	-0.62
DEL4	14	+1.50	-1.21
DEL2	13	+1.78	-1.85
DEL1	12	+2.66	-0.66
Total	119	+2.57	-0.63

[a] Difference scores are in raw score form representing total gain or loss out of 52 points.

A 2 x 4 x 3 analysis of variance, with repeated measures on Factor C (pretest, achievement test, retention test), was conducted on the test scores of the sub-sample with the recruits excluded. Table 14 presents a summary of the analysis of variance results.

Table 14. Analysis of Variance of Test Scores[a]
(With Recruits Excluded)

Source	SS	DF	MS	F	P
Between Subjects					
A (FB)	5.86	1	5.86	.08	.773
B (TEST FREQ)	52.09	3	17.36	.25	.863
AB	148.59	3	49.53	.70	.551
Within Cells	7806.50	111	70.32		
Within Subjects					
C (T,RET)	402.69	2	201.34	20.41	.001*
AC	52.72	2	26.36	2.67	.071
BC	18.96	6	3.16	0.32	.926
ABC	36.83	6	6.14	0.62	.712
Within Cells	2190.25	222	9.87		

[a] Pretest, achievement test, and retention test scores were analyzed.
$n = 119$
$*p < 0.05$

The three-way analysis of variance with repeated measures on Factor C (pretest, achievement test, retention test), indicated a significant effect only for Factor C ($F = 20.41$; $df = 2,222$; $p < .05$). There was no significant main effect for Factor A (feedback condition) nor for Factor B (test frequency) nor were there any significant interactions.

In further analyses of variance, Factor A (feedback condition) was removed from the analysis because it accounted for little of the total variance. (Sums of squares for Factor A [feedback condition] was equal to 6.32 and 5.86, respectively, for the analysis of the test scores for the total samples and the analysis of the sub-sample excluding the recruits.)

A two-way repeated-measure ANOVA was conducted with Factor A (frequency of testing) and Factor B, the repeated measure (pretest, achievement test, retention test scores). Table 15 reports the results of the analysis.

Table 15. Analysis of Variance of Test Scores[a] by Test Frequency (With Recruits Excluded)

Source	SS	DF	MS	F	P
Between Subjects					
A (TEST FREQ)	41.22	3	13.74	.20	.897
Within Cells	7962.87	115	69.24		
Within Subjects					
B (T,RET)	429.17	2	214.59	21.66	.001*
AB	21.13	6	3.52	0.35	.906
Within Cells	2279.12	230	9.91		

[a] Pretest, achievement test, and retention test scores were analyzed.
n = 119
$^*p < 0.05$

Once again, there was a significant main effect for Factor B (pretest, achievement test, retention test) ($F = 21.66$; df = 2,230; $p < .05$). However, there was no significant main effect for Factor A (test frequency), nor was there any interaction. Subsequent post hoc Scheffe analysis indicated that both the achievement and retention test score means were significantly higher than the pretest score means.

Discussion

Analyses of the pretest, achievement test, retention test score means indicated a significant training effect for both the total sample and the sub-sample with the recruits excluded. All groups scored significantly higher on the achievement test than on the pretest. However, although these scores were significantly higher, the actual gains represented were comparatively small. A mean gain of 6.5% was found between the pretest and achievement test mean scores for the total sample (63.9% and 70.4%, respectively). When the data for the recruits were excluded from the analysis, the resulting mean gain of 4.9% between the pretest and achievement test scores for this sub-sample was less than that for the total sample, but statistically still significant.

In all of the analyses, there was no significant main effect for immediate/delayed feedback. The study failed to elicit a Delay-Retention Effect. These results are similar to those studies reviewed in Chapter 2 which also utilized computer-assisted instruction (Sheridan, 1980; Gaynor, 1981).

Contrary to the DRE hypothesis, the retention test scores of the groups receiving 24-hour delayed feedback did not increase in comparison with the groups receiving immediate feedback. Rather, the groups receiving 24-hour delayed feedback showed a slight decrement in retention test scores similar to the other groups. Only two groups had higher mean scores on the retention test than on the achievement test; the 8-test immediate feedback group (IMM8) and the 4-test immediate feedback group (IMM4) had slight, non-significant, gains on the retention test.

There are several possible explanations for the non-occurrence of the Delay-Retention Effect. First, the delay may not have been precisely 24 hours for all subjects. Although efforts were made to time the delay interval precisely, some of the subjects may have received test feedback in excess of 24 hours after completing their module test, e.g. 24 to 48 hours. As a result, the advantages of 24-hour delayed feedback may have ameliorated over this interval. A second explanation may lie in the fact that the pretest scores were relatively high. Unlike many other studies of the Delay-Retention Effect, this study used content that was familiar to most of the subjects. As a result, the pretest scores were likely higher than if the study had utilized content unfamiliar to subjects. The negligible decrease between achievement and retention test scores adds support to this explanation. Although the retention test was administered 10 weeks following the completion of the 4-month training program, little decrement between achievement and retention test score means occurred. This result may be due to the continuing on-the-job practice of the knowledge and concepts taught within the training program. A third explanation may be provided by the training program itself. As the discussion of training time shows in a following section, subjects spent approximately three hours in training over a four-month period. This instruction may not have been intensive enough to elicit a Delay-Retention Effect.

Testing frequency did not appear to effect differences among achievement test and retention test scores. In all of the analyses, there was no main effect for frequency of testing. Mean test scores of the more frequently tested groups were not significantly different from those of the less frequently tested groups. These results are similar to those of several studies discussed in Chapter 2 which reported that frequent testing did not enhance performance on a final test (Popham & Standlee, 1960; Robinson, 1972; Mayer & Rojas, 1982; Lindenberg, 1984).

Analysis of Module Test Scores

In addition to the pretest, achievement test, and retention test, subjects completed one or more module tests. Table 16 lists the mean scores obtained for the module test(s). Means are reported as raw scores, representing the total number of correct items out of 104. Standard deviations appear in parentheses beneath each mean.

Table 16. Module Test Scores[a]

Treatment Group	n	Module Test Score
IMM8	21	91.19 (7.49)
IMM4	18	89.67 (6.56)
IMM2	19	86.53 (8.20)
IMM1	21	84.79 (7.75)
DEL8	16	93.94 (4.48)
DEL4	18	87.17 (8.13)
DEL2	16	86.38 (7.77)
DEL1	16	82.13 (6.87)
Total	145	87.78 (7.89)

[a] Mean scores are in raw score form representing the number of points scored out of 104 points.

As Table 16 shows, module test score means ranged from a high of 93.94 (90.3%) for the 8-test delayed feedback group to 82.13 (78.9%) for the 1-test delayed feedback group. The mean for the total sample was 87.78 (84.4%). Figure 2 illustrates the module test score means for the various treatment groups.

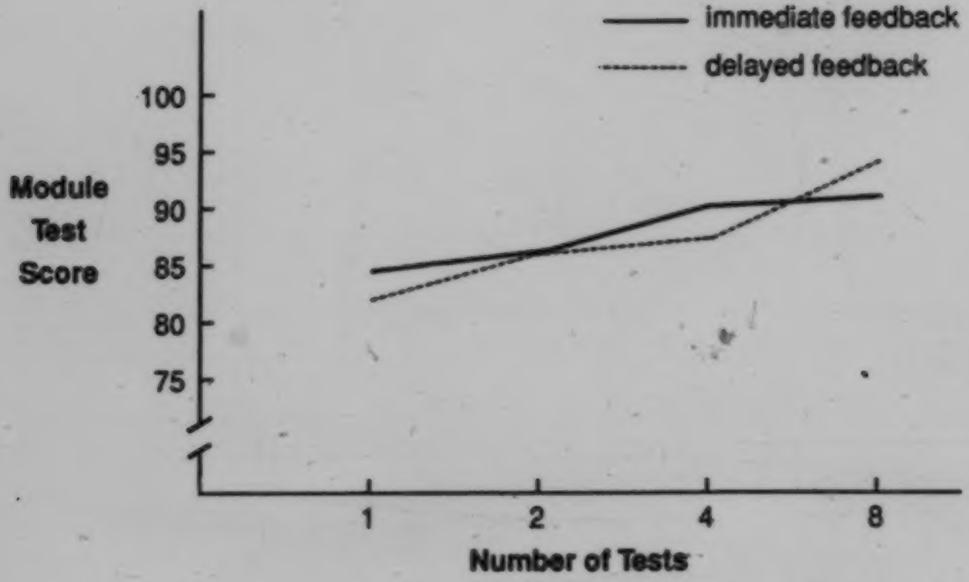

Figure 2. Module Test Scores

A 2 x 4 analysis of variance was conducted on the module test scores in order to determine the effects of Factor A (immediate/delayed feedback) and Factor B (test frequency). Table 17 presents the summary analysis of variance results.

Table 17. Analysis of Variance of Module Test Scores

Source	SS	DF	MS	F	P
Main Effects	1491.79	4	372.95	7.01	.000
A (FB)	13.67	1	13.67	0.26	.613
B (TEST FREQ)	1473.88	3	491.29	9.23	.000*
Interaction					
AB	172.97	3	57.66	1.08	.358
Explained	1664.77	7	237.82	4.47	.000
Residual	7184.07	135	53.21		
Total	8848.84	142	62.32		

n = 143 (2 cases were missing)
*p < .05

The main effect of Factor B, test frequency, was statistically significant (F = 9.23; df = 3,142; p < .05). No significant main effect of feedback condition was evident nor was there a significant interaction.

Discussion

Analysis of the module test means indicated a significant effect for testing frequency. Subjects in the more frequently tested groups, regardless of whether they received immediate or delayed feedback, scored higher on module tests than subjects in the less frequently tested groups.

There are at least two possible explanations for this effect. First, frequently tested subjects were tested on material they had recently encountered in a CAI module. Consequently, they were able to recall the facts or apply the concepts more readily. Subjects receiving less frequent testing, however, were required to recall information from modules they had studied in the past. As a result, errors may have occurred because they had forgotten the necessary information or remembered it incorrectly.

A second possible explanation is that frequently tested subjects received shorter tests than the less frequently tested subjects. The frequently tested subjects were able to complete the module tests quickly and relatively effortlessly. Less frequently tested subjects, on the other hand, received longer tests which required greater attention and concentration to complete. As a result, test fatigue may have affected the test scores of subjects who were tested less frequently, since the tests they took were longer than those of the more frequently tested subjects.

Nevertheless, although frequent testing appeared to result in higher module test scores, which may reflect greater knowledge of facts and concepts, there was no evidence that this effect was maintained for any substantial period of time. Analysis of the achievement and retention test scores failed to show any differences between the more frequently tested groups and the less frequently tested groups.

Later sections of this chapter explore these points further when analysis of time spent on testing is presented and in the analysis of the questionnaire in which subjects' reactions to the testing frequency and test duration are reported.

Analysis of Employment Categories

Further analyses were conducted in order to explore the effect of years of CXPD employment on pretest, achievement test, and retention test performance. The data were categorized according to length of CXPD employment.

Six categories were established: 0 years (recruits); 1 year; 2-6 years; 7-10 years; 11-15 years; and 16 years or more. The mean pretest, achievement test, and retention test scores for these six employment categories are presented in Table 18. Standard deviations appear in parentheses beneath each mean.

Table 18. Test Scores[a] by Years of CXPD Employment

	Years of Employment					
Tests	0 (n=26)	1 (n=23)	2-5 (n=27)	6-10 (n=27)	11-15 (n=22)	16+ (n=20)
Pretest	27.54 (4.47)	31.22 (4.86)	37.41 (3.58)	36.04 (5.02)	34.45 (4.57)	32.25 (7.37)
Achievement Test	34.54 (4.96)	34.52 (5.38)	40.33 (4.67)	37.78 (3.80)	37.73 (4.78)	33.85 (5.87)
Retention Test	34.81 (3.84)	33.61 (5.94)	39.69 (3.56)	37.56 (3.93)	37.00 (4.30)	33.25 (6.10)

[a] Scores are reported in raw score format representing the total number of correct items out of 52.
n = 145

The mean pretest, achievement test, and retention test scores for the six employment categories are illustrated in Figure 3.

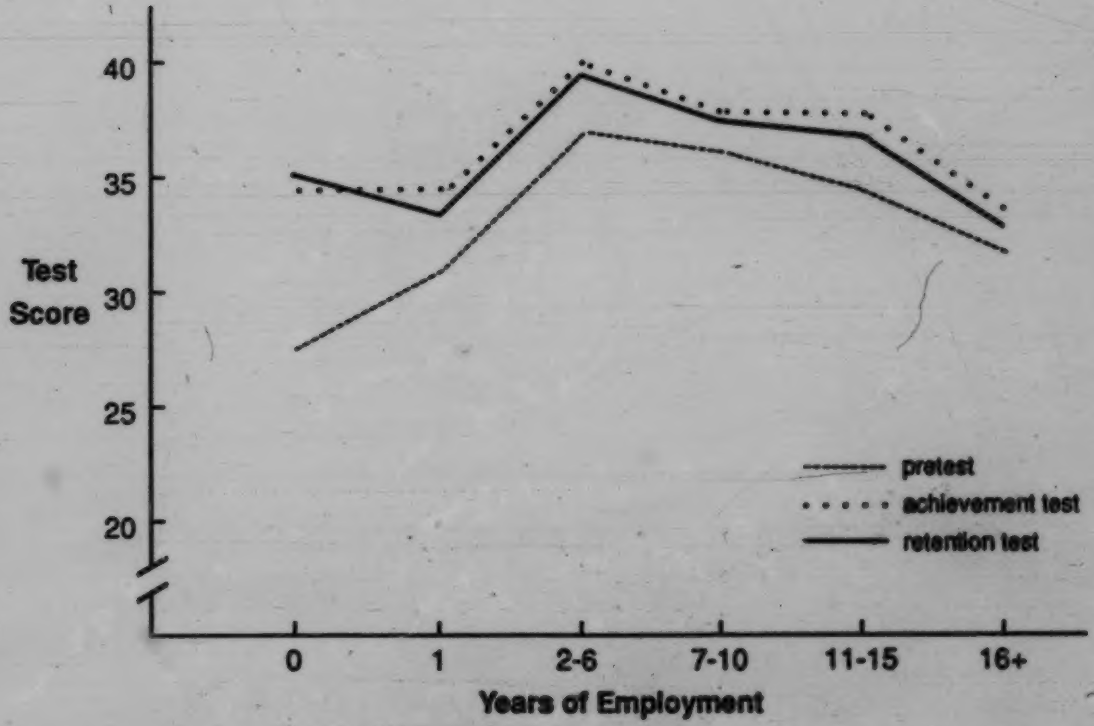

Figure 3. Test Scores by Years of CXPD Employment

The difference scores between the mean pretest and achievement test scores, and the mean achievement test and retention test scores for each employment category are reported in Table 19.

Table 19. Mean Difference Scores by Years of CXPD Employment[a]

	Years of Employment					
	0 (n=26)	1 (n=23)	2-5 (n=27)	6-10 (n=27)	11-15 (n=22)	16+ (n=20)
Pretest, Achievement Test	+7.00	+3.30	+2.92	+1.38	+3.28	+1.60
Achievement Test, Retention Test	+0.27	-0.91	-0.74	-0.22	-0.73	-0.60

[a] Difference scores are reported as raw scores representing the number of points gained or lost out of 52.

Examination of Table 19 shows that recruits made the largest mean gain over the duration of the training program, showing an increase between pretest and achievement test score means of 7.00 (13.5%). Members with seven to ten years of CXPD employment experienced the least mean gain (1.38 or 2.6%). Differences between mean achievement test and retention test scores were slight, ranging from a gain of 0.27 (0.5%) for the recruits to a loss of 0.91 (1.7%) for the one-year CXPD members.

In order to examine differences among pretest, achievement test, and retention test scores and years of employment, a two-way repeated-measure analysis of variance was conducted using Factor A, length of employment, and Factor B, the pretest, achievement test, retention test repeated measure. Summary results of the analysis appear in Table 20.

Table 20. Analysis of Variance of Test Score Means[a] by Years of CXPD Employment

Source	SS	DF	MS	F	P
Between Subjects					
A (EMPLOYMENT)	2687.50	5	537.50	10.59	.001*
Within Cells	7053.00	139	50.74		
Within Subjects					
B (PT,ACH,RET)	912.45	2	456.22	46.42	.001*
AB	362.37	10	36.24	3.69	.001*
Within Cells	2732.50	278	9.83		

[a] Pretest, achievement test, and retention test score means were analyzed.
n = 145
*p < .05

A significant main effect was found for Factor A, length of employment (F = 10.59; df = 5,139; p < .05). Factor B (pretest, achievement test, retention test) was also significant (F = 46.42; df = 2,278; p < .05). There was a significant interaction between the factors as well (F = 3.69; df = 10,278; p < .05). The pretest-achievement test difference was markedly larger for the recruit group than for any of the other groups. In addition, the recruit group differed from all other groups in that they performed somewhat better on the retention test than on the achievement test. All the other groups had slightly higher mean scores on the achievement test than on the retention test.

Post hoc Scheffe analysis indicated that the scores of the following groups were significantly different at the 0.05 level:

1. Pretest scores for recruits were significantly lower than members with 11-15 years, 7-10 years, and 2-6 years of CXPD employment;

2. Pretest scores of 1-year members were significantly lower than members with 7-10 years and 2-6 years of CXPD employment;

3. Pretest scores of members with 16 or more years of CXPD employment were significantly lower than those members with [illegible] years of CXPD employment.

4. Achievement test scores for the group with 2-6 years of CXPD employment were significantly higher than the recruits, the 1-year members, and those who had been employed for 16 or more years;

5. Retention test scores for the group with 2-6 years of employment with the CXPD were significantly higher than the retention test scores for the recruits, the 1-year members, and those with 16 or more years of CXPD employment.

Discussion

Length of employment appeared to be a significant factor affecting pretest, achievement test, and retention test scores. As expected, the mean pretest score for the recruits was lower than the mean of all the other, more experienced, groups. The mean pretest score of the group of recruits was significantly lower than CXPD members with 2-6 years, 7-10 years, and 11-15 years of experience. However, as a group, recruits made the greatest mean gain, showing an increase of 7.00 points (13.5%) between the pretest and achievement test. As a result, on the achievement and retention tests they scored significantly lower only in comparison to the group with 2-6 years of CXPD employment.

The following differences were found for the other [illegible]

1. Members of the CXPD who had been employed for one year scored significantly lower on the pretest than CXPD members with 2 to 6 years and those with 7 to 10 years of CXPD employment. On the achievement and retention tests, they scored significantly lower than the 2 to 6 year members. However, the 1-year members showed a mean gain of 3.30 (6.4%) between the pretest and achievement test, the second highest gain observed.

2. Members who had been employed from 2 to 6 years had significantly higher achievement and retention test score means than recruits, 1-year members, and those with 16 or more years of CXPD experience. Between the pretest and achievement test, members with 2-6 years of CXPD employment demonstrated a 2.92 (5.6%) increase in mean test scores.

3. Members with 7 to 10 years of CXPD employment had significantly higher pretest scores than recruits and 1-year members. Between the pretest and achievement test, members with 7 to 10 years of CXPD employment demonstrated a 1.38 (2.6%) increase in mean test scores, the smallest increase noted among the groups.

4. Members with 11 to 15 years of CXPD employment had significantly higher pretest scores than the recruits. They had a mean gain of 3.28 (6.3%) between the pretest and achievement test.

5. Police force members with 16 or more years of experience had significantly lower pretest, achievement test, and retention test score means than members with 2 to 6 years experience. Members with 16 or more years of CXPD employment had the second lowest gain between the pretest and achievement test of any group, showing a 1.6 (3.1%) increase in mean test scores.

These results indicate that both very new and very experienced members of the CXPD may have knowledge deficits (as measured by the pretest, achievement test, and retention test), in comparison to members with a moderate amount of CXPD experience. There are several possible explanations. Clearly recruits and 1-year members do not have the experience and hence the knowledge base of other more experienced members. Lower test scores are not surprising for these groups. Members with a moderate amount of CXPD experience, e.g., 2 to 6 years, may be more likely to work "on the street". As such, their work causes them to apply the facts and concepts tested in this study on a daily basis. Similarly, members with a great deal of CXPD experience may be more likely to work in an administrative job and, as a result, be less familiar with the facts and concepts tested in this study. Furthermore, police force members with 2-6 years of experience had been trained exclusively on the computer-based training system during their employment, unlike members with more experience who had encountered the earlier, less effective training system (Szabo, 1988).

In addition, very experienced members of the CXPD are likely older than less experienced members. As a result, they may be affected by decreased memory and learning ability evident in more mature learners (Knox, 1986).

These explanations must be considered in view of the comparatively small differences found among the test scores in the pretest, achievement test, and retention test, however. With the exception of the recruits, the differences between pretest and achievement test mean scores were slight, ranging from 3.1% to 6.3%.

Analysis of Training Time

If testing frequency and immediacy of feedback do not affect achievement and retention test scores, then other measures relating to training efficiency may become important. If indeed cost effectiveness is an important criterion of training programs, then instructional strategies which minimize training time, without showing a decrement in learning, may be preferable. In order to determine the training time associated with this study, the amount of time spent by each subject both studying the CAI modules and completing the module test(s) was determined. (The time which subjects spent on the pretest, achievement test, and retention test was not included in the analyses.)

Table 21 presents the average time, in minutes, which each group spent on modules, on module tests, and in total. Standard deviations appear in parentheses beneath each mean.

Table 21. Average Training Time[a]

Group	n	Modules	Tests	Total
IMM8	21	137.48 (33.68)	38.47 (10.68)	175.95 (37.54)
IMM4	18	183.67 (62.83)	50.22 (17.74)	233.89 (75.67)
IMM2	19	156.79 (45.93)	50.79 (13.29)	207.58 (53.43)
IMM1	18	161.00 (44.09)	54.42 (14.38)	216.06 (48.93)
DEL8	16	166.94 (68.91)	45.94 (12.59)	212.88 (75.14)
DEL4	16	150.33 (46.34)	54.61 (17.92)	204.94 (61.22)
DEL2	18	167.87 (56.38)	57.87 (16.65)	225.75 (67.84)
DEL1	16	125.81 (35.12)	51.88 (14.60)	177.69 (41.75)
Total	145	155.96 (51.61)	50.24 (15.61)	206.25 (60.47)

[a] Time is represented in the number of minutes which subjects spent on-line.

The amount of time which subjects spent studying the eight CAI modules of the training program, completing the module test(s), and the total amount of training time, respectively, is illustrated in Figures 4, 5, and 6.

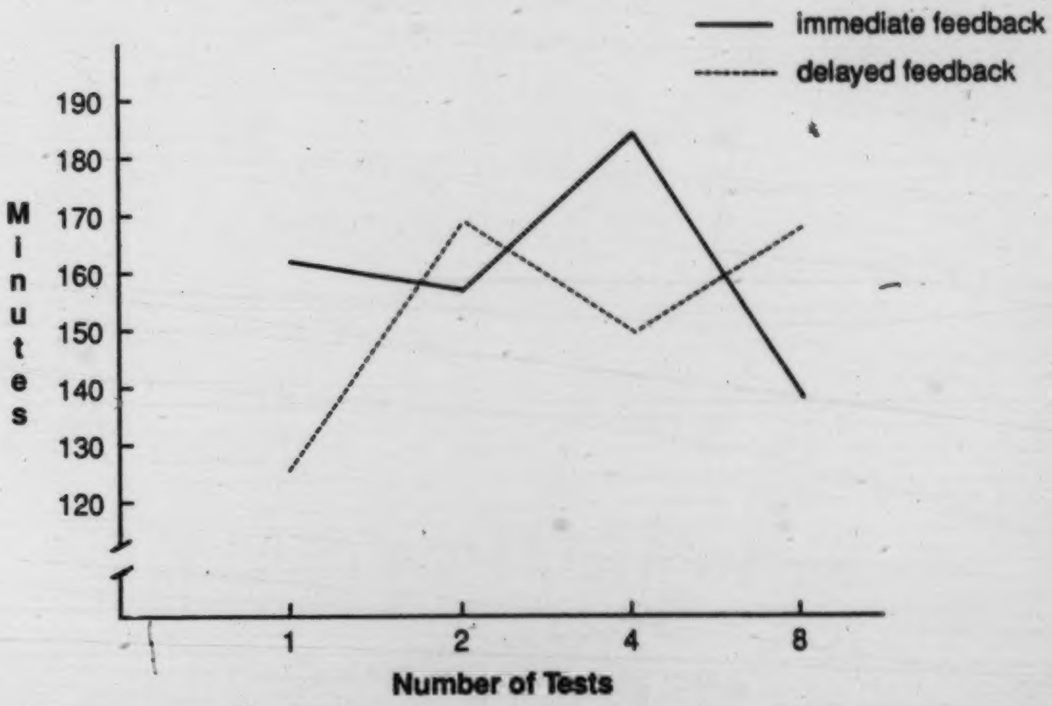

Figure 4. Average Time on Modules

As Figure 4 illustrates, the 8-test immediate feedback group spent less time studying the CAI modules than the 8-test delayed feedback group (137.48 minutes and 166.94 minutes, respectively). The 4-test immediate feedback group spent more time studying the modules than the 4-test delayed feedback group (183.67 minutes and 150.33 minutes, respectively). The 2-test groups showed less difference. The 2-test immediate feedback group spent 156.79 minutes on module study in comparison to 167.87 minutes for the 2-test delayed feedback group. The 1-test immediate feedback group spent more time on modules than the 1-test delayed feedback group (161 minutes and 125.8 minutes, respectively).

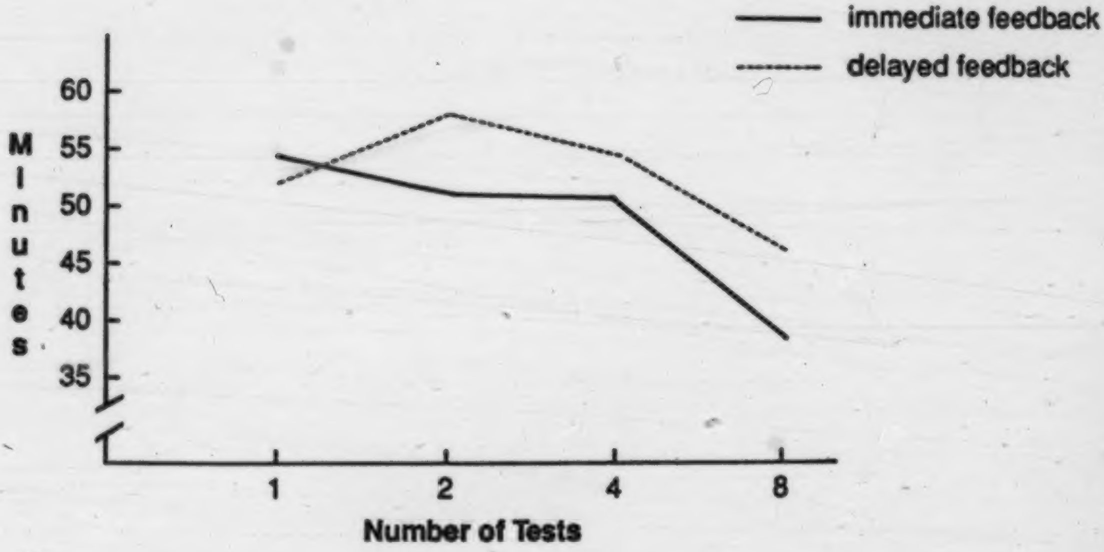

Figure 5. Average Time on Module Testing

The amount of time which subjects spent completing the 104 items on the module test(s) is illustrated in Figure 5. As the figure shows, time spent completing the module test(s) ranged from 38.47 minutes for the 8-test immediate feedback group and 45.94 minutes for the 8-test delayed feedback group, to 54.42 minutes for the 1-test immediate feedback group and 51.88 minutes for the 1-test delayed feedback group.

Total training time (time on modules plus time on module tests) is illustrated in Figure 6.

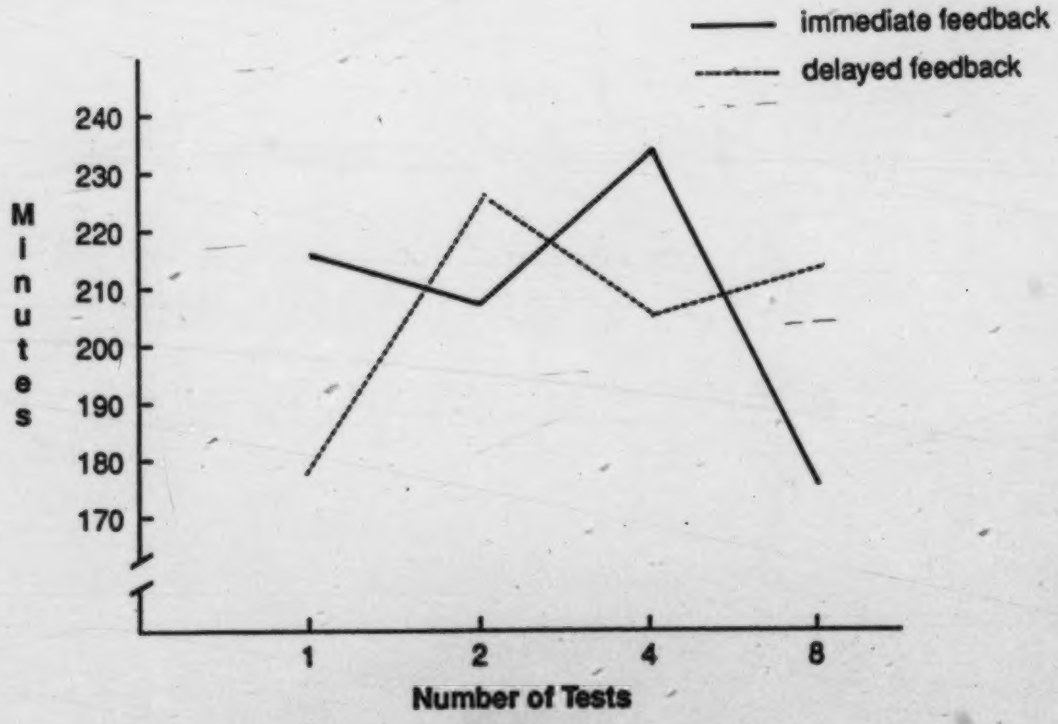

Figure 6. Average Total Training Time

As Figure 6 illustrates, the 8-test immediate feedback group and the 1-test delayed feedback group spent the least amount of total training time (175.95 and 177.69 minutes, respectively). The 4-test immediate feedback group (IMM4) and the 2-test delayed feedback group (DEL2) spent the most amount of time in training (233.89 and 225.75 minutes, respectively).

Using separate 2 x 4 analyses of variance, the data for module time, testing time, and total training time were analyzed in relation to Factor A, immediate/24-hour delayed feedback, and Factor B, test frequency. The results are reported in Tables 22, 23, and 24.

Table 22. Analysis of Variance of Time on Modules

Source	SS	DF	MS	F	P
Main Effects	12893.82	4	3223.45	1.29	.277
A (FB)	1557.01	1	1557.01	0.62	.431
B (TEST FREQ)	11558.16	3	3852.72	1.54	.207
Interaction					
AB	27880.41	3	9293.47	3.72	.013*
Explained	40774.22	7	5824.88	2.33	.028
Residual	334743.52	134	2498.09		
Total	375517.75	141	2663.25		

n = 142 (3 cases were missing)
*p < .05

No significant main effects were found for feedback condition or test frequency in relation to the amount of time which subjects spent studying the CAI modules. There was a significant interaction, however ($F = 3.72$; $df = 3,141$; $p < .05$). Although no overall differences in module study time were found between the various feedback and test frequency groups, the significant interaction indicated that differences did exist among some of the groups. This interaction was illustrated in Figure 4. The 1-test and 4-test immediate feedback groups spent more time studying the CAI modules than their delayed feedback counterparts, however, the 8-test showed the opposite trend. The 2-test group showed little difference in module study time between the immediate and delayed feedback groups.

Table 23. Analysis of Variance of Time on Module Tests

Source	SS	DF	MS	F	P
Main Effects	4295.21	4	1073.80	4.88	.001
A (FB)	606.91	1	606.91	2.76	.099
B (TEST FREQ)	3594.13	3	1198.04	5.44	.001*
Interaction					
AB	564.37	3	188.12	0.85	.467
Explained	4859.58	7	694.23	3.15	.004
Residual	29728.85	135	220.21		
Total	34588.43	142	243.58		

n = 143 (2 cases were missing)
*p < .05

Analysis of the amount of time spent on module testing indicated a significant main effect for Factor B, test frequency ($F = 5.44$; $df = 3,142$; $p < .05$). There was no significant effect for feedback condition nor was there a significant interaction.

In other words, there were significant differences among the amount of time spent on module testing with respect to test frequency. As Figure 5 illustrates, the more frequently tested groups spent less time on module tests than the less frequently tested groups. For example, subjects who were required to do eight tests spent less time than subjects who were required to do only one test, even though the total number of test items was the same for each group.

Table 24. Analysis of Variance of Total Training Time

Source	SS	DF	MS	F	P
Main Effects	19645.98	4	4911.49	1.43	.228
A (FB)	232.16	1	242.16	0.07	.791
B (TEST FREQ)	19534.57	3	6511.52	1.89	.134
Interaction					
AB	35015.45	3	11671.82	3.40	.020*
Explained	54661.43	7	7808.78	2.27	.033
Residual	461197.44	134	3441.77		
Total	515858.87	141	3658.57		

n = 142 (3 cases were missing)
*p < .05

Analysis of the total training time, i.e., the amount of time which subjects spent studying modules and completing module tests, indicated a significant interaction between feedback condition and test frequency ($F = 3.40$; $df = 3,141$; $p < .05$). There were no significant main effects, however. Figure 6 illustrates the nature of the interaction. This interaction is due to the significant interaction found in time on modules described earlier. This is not surprising since module time accounted for a major portion of total training time. Once again, the 1-test and 4-test immediate feedback groups spent more time on the training program than their delayed feedback counterparts. The 2-test and 8-test immediate feedback groups, however, spent less time on the training program than their counterparts who received delayed feedback. No apparent explanation was evident for these differences, however.

Training time was also examined in terms of the amount of time which subjects within the six employment categories spent on modules, on module tests, and in total. Means and standard devisions for these data are reported in Table 25.

Table 25. Module Time, Testing Time, and Total Training Time[a] Means and Standard Devisions by Years of CXPD Employment

	Years of Employment					
	0	1	2-5	6-10	11-15	16+
Number of Subjects	26	22	27	27	22	19
Module Time	153.65 (58.50)	155.68 (51.34)	149.70 (42.46)	139.53 (33.42)	162.27 (51.53)	183.47 (66.91)
Testing Time	55.50 (16.94)	54.41 (18.72)	44.18 (11.82)	47.54 (15.49)	50.45 (14.04)	50.30 (14.39)
Total Time	209.15 (72.08)	210.09 (64.30)	193.89 (47.34)	187.08 (40.84)	212.73 (61.13)	234.16 (71.00)

[a] Time is represented in the number of minutes which subjects spent on-line.

A one-way analysis of variance was conducted on each of the three variables for the six employment categories. Summary results of these analyses are reported in Tables 26, 27, and 28.

Table 26. Analysis of Variance of Time Spent on Modules

Source	SS	DF	MS	F	P
Between Groups	23467.75	5	4695.58	1.81	.114
Within Groups	352049.85	136	2588.60		
Total	375517.74	141			

n = 142 (3 cases were missing)

Table 27. Analysis of Variance of Testing Time

Source	SS	DF	MS	F	P
Between Groups	2282.42	5	456.48	1.94	.092
Within Groups	32306.01	137	245.81		
Total	34588.43	142			

n = 143 (2 cases were missing)

Table 28. Analysis of Variance of Total Training Time

Source	SS	DF	MS	F	P
Between Groups	29948.27	5	5989.65	1.67	.144
Within Groups	485910.61	136	3572.87		
Total	515858.87	141			

n = 142 (3 cases were missing)

Analyses of module time, testing time, and total instructional time indicated no significant differences among the six categories of length of CXPD employment.

Discussion

Both testing frequency and immediacy/delay of feedback appeared to affect the amount of time which subjects spent in training, i.e., studying the eight CAI modules and completing the module test(s).

The time spent by the eight treatment groups on the CAI modules ranged between 2.1 and 3.1 hours. There was an interaction effect between the number of tests which subjects received and the amount of time they spent studying the CAI modules. The 1-test delayed feedback group spent the least amount of time studying the modules (125.8 minutes or 2.1 hours). However, it is noteworthy that this group also had the lowest mean module test score as is indicated in Figure 6.

Over the remaining seven groups, module study time ranged from a low of 137.48 minutes (2.3 hours) for the 8-test immediate feedback group to a high of 183.67 minutes (3.1 hours) for the 4-test immediate feedback group. Although the 8-test immediate feedback group spent the next-to-least amount of time studying the eight CAI modules over all groups, their module test score mean was the next-to-highest.

Figure 7 illustrates the relationship between module test score means and amount of time which each group spent on modules.

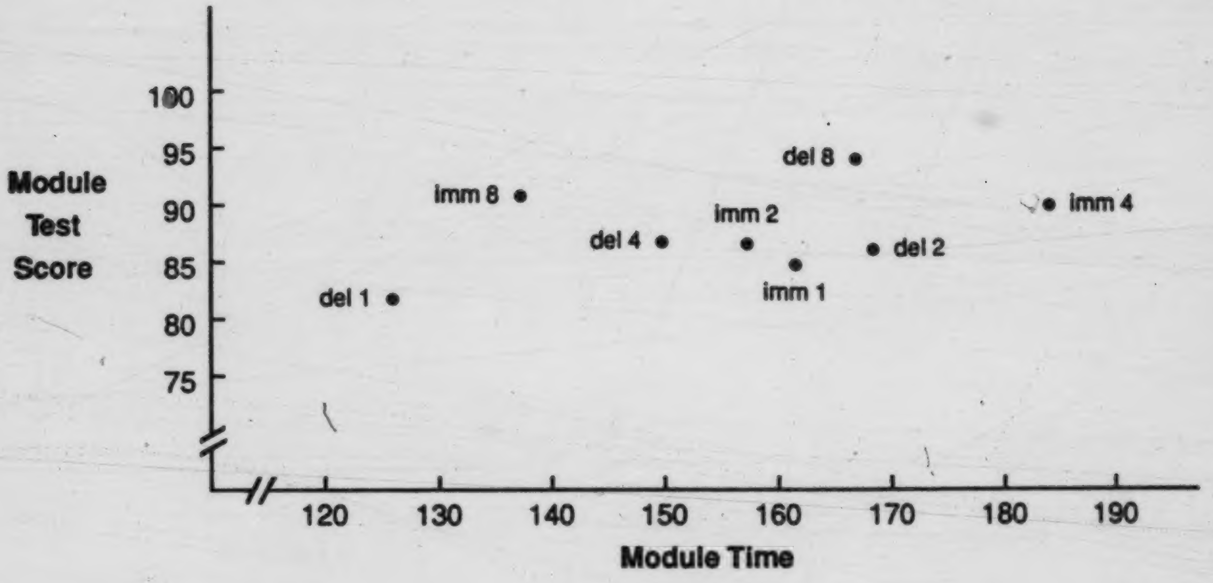

Figure 7. Module Time[a] and Module Test Score(s)[b]

[a] Time is represented by the number of minutes which subjects spent on-line studying the eight CAI modules in the training program.

[b] Module test scores are reported in raw score form representing the number of items correct out of 104.

The amount of time spent on module tests appeared to be affected by both testing frequency and type of feedback; more frequent testing and immediate feedback both had lower times.

In general, there was an inverse relationship between frequency of testing and time on tests. Although all groups completed a total of 104 module test items, the more frequently tested groups spent less time on testing. The 8-test immediate feedback group spent the least amount of time on module tests (38.47 minutes); the 2-test delayed feedback group spent the most amount of time on module tests (57.87 minutes).

The reasons proposed earlier to explain why more frequently tested groups had higher module test scores may also help to explain why testing time was less for these groups. First, more frequently tested subjects may have been better able to recall the facts and concepts needed to answer the module test items. They had studied the module(s) more recently than the less frequently tested groups and, hence, their recall was faster as well as more accurate. Furthermore, they had less material to examine and therefore they were able to quickly access the pertinent information. Theories relating to levels of processing in encoding (Einstein & Hunt, 1980; Hunt & Einstein, 1981) may help explain why the more frequently tested groups may have had faster access times to information stored in memory than less frequently tested groups. Second, the shorter tests associated with more frequent testing required less energy and concentration to complete. The time spent on the longer tests received by less frequently tested subjects may have been extended by test fatigue.

An interesting outcome of this study is the apparent effect that feedback delay had on the amount of time spent on module tests. In general, although not statistically significant, the groups which received immediate feedback spent less time in testing than the groups who received 24-hour delayed feedback. With the exception of the 1-test groups, all groups receiving 24-hour delayed feedback spent more time on the module tests than their immediate feedback counterparts.

In other words, although subjects in the immediate feedback groups had to read the test question, enter a response, and read the corresponding feedback -- in comparison to the delayed feedback groups which only read the test question and enter a response -- groups receiving immediate feedback spent less time taking the module tests than those receiving delayed feedback (i.e., no feedback during the testing sessions). Furthermore, the delayed feedback groups spent more time in tasks associated with testing than was recorded. The amount of time which these subjects incurred travelling to receive the feedback was not included in the testing time recorded for the study.

The differences in testing time between the immediate and delayed feedback groups can be explained somewhat by Kulhavy and Anderson's (1972) study which noted that subjects spent more time studying feedback when it was presented after 24 hours than they did when the feedback was presented immediately. As the present study seems to show, subjects who received feedback immediately following the presentation of each test item appear to spend little time studying it.

Confidence may provide a second explanation. Subjects who received no feedback during the test session may have been less confident about their performance on the test than subjects who received feedback. As a result, they worked more slowly through the test, unsure of how they were performing. This explanation is supported by Sheridan (1980), who reported that immediate feedback resulted in much higher confidence in answers than did delay of feedback.

A third explanation may lie in expectancy. Computer-assisted instruction may provide learners with the expectation of receiving immediate feedback to their test responses. By imposing a time delay between the presentation of test items and the feedback, this expectancy was not met. Frustration may have resulted which slowed the testing process. This explanation is supported by More (1969) who recommended 24 hours as the optimal delay for returning graded assignments to students. He stated that a 24-hour delay in feedback was acceptable to students in a classroom situation. In addition, Kulhavy (1977) acknowledged the importance of learner expectations and their influence upon the use of feedback. He discussed learner expectations in terms of confidence, and added that other learner characteristics should be explored further. Learner expectancy with regards to feedback in computer-assisted instruction is an area that may require further study.

Correlational Analysis

Correlational analyses were performed in order to examine relationships between the following variables: feedback condition, pretest score, achievement test score, retention test score, module test(s) score, time on testing, time on modules, total time, and years of employment. Table 29 lists the obtained Pearson product-moment correlation coefficients for the above listed variables with all treatment groups combined (n = 145) and with separated test frequency groups. However, the following correlations must be considered in view of the large numbers of comparisons being made, i.e., they are not independent. As a result, the correlations within columns are not independent.

Table 29. Correlation Coefficients (r) for All Groups Combined and by Test Frequency Groups

Variables	Correlation (r)				
	Combined (n=145)	8-tests (n=37)	4-tests (n=36)	2-tests (n=35)	1-test (n=37)
Feedback X					
Pretest Score	.04	.10	-.07	.21	-.07
Achievement Test Score	-.04	.24	-.18	-.03	-.20
Retention Test Score	-.07	.19	-.26	-.05	-.03
Module Test(s) Score	-.04	.21	-.17	-.01	-.18
Testing Time	.14*	.31*	.12	.24	-.09
Module Time	-.06*	.27*	-.29*	.11	-.41*
Total Time	-.01	.31	-.21	.15	-.40*
Employment	-.05	-.08	.02	.05	-.19
Pretest Score X					
Feedback	.04	.10	-.07	.21	-.07
Achievement Test Score	.58*	.65*	.65*	.49*	.54*
Retention Test Score	.61*	.63*	.67*	.51*	.61*
Module Test(s) Score	.56*	.68*	.66*	.62*	.38*
Testing Time	-.20*	-.34*	-.13	-.15	-.16
Module Time	-.15	-.01	-.12	-.08	.05
Total Time	-.09	-.05	-.14	-.11	.01
Employment	.17*	.01	.36*	.10	.16
Achievement Test Score X					
Feedback	-.04	.24	-.18	-.03	-.20
Pretest Score	.58*	.65*	.65*	.49*	.54*
Retention Test Score	.76*	.70*	.83*	.80*	.71*
Module Test(s) Score	.58*	.49*	.63*	.69*	.67*
Testing Time	.08	-.05	.09	.12	.17
Module Time	-.04	-.05	.02	.22	.09
Total Time	-.02	-.05	.04	-.16	.13
Employment	-.04	-.25	.05	.01	.01
Retention Test Score X					
Feedback	-.07	.19	-.26	-.05	-.03
Pretest Score	.61*	.63*	.67*	.50*	.61*
Achievement Test Score	.76*	.70*	.83*	.80*	.71*
Module Test(s) Score	.56*	.42*	.67*	.78*	.44*
Testing Time	-.03	-.23	.04	.12	-.05
Module Time	-.05	-.12	.05	-.23	.07
Total Time	-.06	-.15	.05	-.16	.04
Employment	-.07	-.26	.08	-.07	-.08

Table 29. Correlation Coefficients (r) for All Groups Combined and by Test Frequency Groups (cont'd.)

Variables	Correlation (r) Combined (n=145)	8-tests (n=37)	4-tests (n=36)	2-tests (n=35)	1-test (n=37)
Module Test(s) Score X					
Feedback	-.04	.21	-.17	-.01	-.18
Pretest Score	.56*	.69*	.66*	.62*	.38*
Achievement Test Score	.58*	.49*	.62*	.70*	.67*
Retention Test Score	.56*	.42*	.67*	.78*	.44*
Testing Time	-.13*	-.44*	.05	-.08	.27*
Module Time	-.04	-.04	-.03	-.24	.09
Total Time	-.07	-.12	-.02	-.22	.16
Employment	-.02	.15	.14	-.08	-.22
Testing Time X					
Feedback	.14*	.31*	.12	.24	-.09
Pretest Score	.20*	-.34*	-.13	-.15	-.16
Achievement Test Score	.08	-.05	.09	.12	.17
Retention Test Score	-.03	-.23	.04	.12	-.05
Module Test(s) Score	-.13*	-.13*	.05	-.08	.27*
Module Time	.46*	.44*	.62*	.55*	.25
Total Time	.65*	.56*	.77*	.71*	.52*
Employment	-.09	-.22	.03	-.02	-.14
Module Time X					
Feedback	-.06	.27*	-.29*	.11	-.41*
Pretest Score	-.04	.01	-.12	-.08	.05
Achievement Test Score	-.04	-.05	.03	-.22	.09
Retention Test Score	-.05	-.12	.05	-.23	.07
Module Test(s) Score	-.04	-.04	-.03	-.24	.10
Testing Time	.46*	.44*	.63*	.55*	.25
Total Time	.97*	.98*	.98*	.98*	.96*
Employment	.18*	.13	.30*	.22	.05
Total Time X					
Feedback	-.01	.31	-.21	.15	-.39*
Pretest Score	-.09	-.06	-.13	-.11	.01
Achievement Test Score	-.02	-.05	.04	-.15	.14
Retention Test Score	-.05	-.15	.05	-.16	.05
Module Test(s) Score	-.07	-.12	-.02	-.22	.16
Testing Time	.65*	.5[illegible]	.77*	.72*	.52*
Module Time	.97*	.98*	.98*	.98*	.96*
Employment	.12	.07	.26	.18	.01

Table 29. Correlation Coefficients (r) for All Groups Combined and by Test Frequency Groups (cont'd.)

Variables	Correlation (r) Combined (n=145)	8-tests (n=37)	4-tests (n=36)	2-tests (n=35)	1-test (n=37)
Employment X					
Feedback	-.05	-.08	.02	.05	-.19
Pretest Score	.17*	.01	.36*	.10	.16
Achievement Test Score	-.04	-.25	.05	.01	.01
Retention Test Score	-.07	-.26	.08	-.07	-.08
Module Test(s) Score	.02	.15	.14	-.08	-.22
Testing Time	-.09	-.22	.03	-.02	-.14
Module Time	.17*	.12	.30	.22	.05
Total Time	.12	.07	.26	.18	.01

* Correlations which are significantly different from zero ($p < .05$).

A second set of correlational analyses were conducted with the data for the recruits excluded from the sample. These results appear in Table 30.

Table 30. Correlation Coefficients (r) for All Groups Combined and by Test Frequency Groups (Recruits Excluded)

Variables	Correlation (r)				
	Combined (n=145)	8-tests (n=37)	4-tests (n=36)	2-tests (n=35)	1-test (n=37)
Feedback X					
Pretest Score	.11	.17	.01	.25	.04
Achievement Test Score	.02	.22	-.17	.05	-.03
Retention Test Score	-.05	.15	-.28	-.05	.02
Module Test(s) Score	.02	.27	-.08	.01	-.07
Testing Time	.11	.27	.02	.25	-.01
Module Time	-.12	.17	-.46*	.10	-.31
Total Time	-.08	.21	-.38*	.15	-.28
Employment	-.01	-.06	.08	.09	-.16
Pretest Score X					
Feedback	.11	.17	.01	.25	.04
Achievement Test Score	.57*	.70*	.68*	.43*	.45*
Retention Test Score	.64*	.76*	.69*	.48*	.64*
Module Test(s) Score	.51*	.68*	.68*	.53*	.32*
Testing Time	-.08	-.11	.11	-.03	-.30
Module Time	-.06	.18	-.18	-.11	-.10
Total Time	-.07	.15	-.12	-.10	-.18
Employment	.08	-.31*	.25	-.27	-.07
Achievement Test Score X					
Feedback	.02	.22	-.17	.05	-.03
Pretest Score	.57*	.70*	.68*	.43*	.45*
Retention Test Score	.78*	.76*	.83*	.80*	.79*
Module Test(s) Score	.54*	.53*	.70*	.65*	.59*
Testing Time	.12	-.02	.12	.32*	.05
Module Time	.13	.01	-.07	-.20	-.20
Total Time	-.05	.01	-.03	-.09	-.16
Employment	-.17*	-.40*	.02	-.14	-.19
Retention Test Score X					
Feedback	-.05	.15	-.28	-.05	.02
Pretest Score	.64*	.76*	.69*	.48*	.64*
Achievement Test Score	.78*	.76*	.83*	.80*	.79*
Module Test(s) Score	.59*	.54*	.73*	.80*	.47*
Testing Time	-.06	-.23	.09	.23	-.13
Module Time	-.07	-.04	-.01	-.23	-.01
Total Time	-.06	-.01	.01	-.15	-.05
Employment	-.15	-.46*	.06	-.19	-.18

Table 30.—Correlation Coefficients (r) for All Groups Combined and by Test Frequency Groups (Recruits Excluded) (cont'd.)

	Correlation (r)				
Variables	Combined (n=145)	8-tests (n=37)	4-tests (n=36)	2-tests (n=35)	1-test (n=37)
Module Test(s) Score X					
Feedback	.01	.27	-.08	.02	-.07
Pretest Score	.51*	.68*	.69*	.52*	.32*
Achievement Test Score	.54*	.53*	.70*	.65*	.59*
Retention Test Score	.59*	.54*	.73*	.80*	.47*
Testing Time	-.06	-.10	.20	.19	.23
Module Time	-.06	.24	-.04	-.21	-.11
Total Time	-.07	.22	.01	-.15	-.03
Employment	-.15	-.09	.10	-.31*	-.43*
Testing Time X					
Feedback	.11	.27	.02	.25	-.01
Pretest Score	.09	-.11	.11	-.03	-.30
Achievement Test Score	.12	-.02	.12	.32*	.05
Retention Test Score	-.01	-.23	.09	.23	-.13
Module Test(s) Score	-.06	-.10	.20	.19	.22
Module Time	.39*	.06	.66*	.47*	.17
Total Time	.60*	.24	.78*	.65*	.48*
Employment	-.01	.02	.27	-.01	-.28
Module Time X					
Feedback	-.12	.17	-.46*	.10	-.31
Pretest Score	-.06	.17	-.18	-.10	-.10
Achievement Test Score	-.11	.01	-.06	-.20	-.20
Retention Test Score	-.07	.04	-.01	-.23	-.01
Module Test(s) Score	-.06	.25	-.04	-.21	-.11
Testing Time	.40*	.07	.66*	.47*	.17
Total Time	.97*	.98*	.98*	.98*	.95*
Employment	.22*	.33*	.36*	.19	-.02
Total Time X					
Feedback	-.08	.21	-.38*	.15	-.28
Pretest Score	-.07	.15	-.12	-.09	-.17
Achievement Test Score	-.06	.01	-.03	-.09	-.16
Retention Test Score	-.06	-.01	.02	-.15	-.05
Module Test(s) Score	-.07	.22	.01	-.15	-.03
Testing Time	.60*	.24	.78*	.65*	.48*
Module Time	.97*	.98*	.98*	.98*	.95*
Employment	.19*	.32*	.36*	.17	-.10

Table 30. Correlation Coefficients (r) for All Groups Combined and by Test Frequency Groups (Recruits Excluded) (cont´d.)

Variables	Correlation (r) Combined (n=145)	8-tests (n=37)	4-tests (n=36)	2-tests (n=35)	1-test (n=37)
Employment X					
Feedback	-.02	-.06	.08	.09	-.16
Pretest Score	-.08	-.31*	.25	-.27	-.07
Achievement Test Score	-.17*	-.40*	.03	-.14	-.19
Retention Test Score	-.16*	-.45*	.07	-.19	-.17
Module Test(s) Score	-.15	-.09	.10	-.32*	-.43*
Testing Time	-.01	.02	.27	-.01	-.28
Module Time	.22*	.33*	.35*	.19	-.02
Total Time	.19*	.32*	.36*	.17	-.10

* Correlations which are significantly different from zero (p < .05).

Discussion

Throughout the analyses, significant positive correlations ranging between approximately .50 and .80 were found among the pretest, module test(s), achievement test, and retention test scores. In other words, subjects with high scores on the pretest tended to have higher scores on their other tests. The relationships indicated by these correlations likely reflect a general ability or knowledge factor. That is, subjects who are well versed in the information tested by these tests tend to have higher test scores on all the tests in comparison to these subjects who are not as well acquainted with the material.

Subjects receiving delayed feedback tended to spend more time on testing than subjects receiving immediate feedback. This was particularly evident for the 8-test group ($r = .31$) in the analysis of the total sample. The correlation between these variables was not significant once the recruits had been removed from the sample, however. In other words, it appears that delayed feedback may have caused some subjects, particularly the inexperienced recruits, to proceed more slowly through the test because they were unsure of how well they were performing.

There was a significant negative correlation between testing time and pretest score (r = -.20) for the total sample. When the total sample was split by test frequency groups, the only significant correlation between pretest score and testing time was that of the 8-test groups (r = -.34). That is, subjects with lower pretest scores tended to spend more time taking the tests. The relationship was likely attributable to the recruits, as the significant effect disappeared once the data for the recruits were removed from the analysis.

There was a small, but significant, correlation (r = .17) between pretest score and length of CXPD employment for the total sample. This result was sustained for the 2-test groups (r = .36). When the data for the recruits were removed from the analysis, however, the 8-test group indicated a significant negative correlation (r = -.31) between pretest score and length of employment. Once the data for the recruits were removed and the remaining data analyzed, significant negative correlations were also obtained between achievement test score and years of employment (r = -.17) and between retention test score and years of employment (r = -.16). When these correlations were separated by groups, it was found that the 8-test group showed a significant negative correlation between years of employment and achievement test score (r = -.40) and years of employment and retention test score (r = -.45).

These relationships are consistent with the mean pretest, achievement test, and retention test scores reported earlier. The group with 16 or more years of CXPD employment had mean scores of 32.25, 33.85, and 33.25, for the three tests, respectively. These scores are lower, although not significant statistically, than the scores for the sample with the recruits excluded. The pretest, achievement test, and retention test mean scores for this sub-sample were 34.49, 37.06, and 36.43, respectively.

Based on the correlational analysis, it appears that frequently tested subjects with more years of employment tend to have lower achievement and retention test scores than subjects in less frequently tested groups. Possibly these more experienced subjects were less skilled in terms of their test-taking behavior. Likely they were less familiar with taking tests, particularly computer-based tests, than their less experienced counterparts who had more recently received schooling. Furthermore, they may have been less comfortable with the use of computer-based training in comparison to the other subjects with less CXPD experience. As the results of the questionnaire analysis shows in the next section, a proportion of the subjects indicated that they did not like learning via computer-based training. However, as these subjects also had somewhat lower pretest scores, generalization of these findings is difficult.

Attitudes Toward the Training Program

Upon completion of the last module of the training program, but prior to the achievement test, a questionnaire (Appendix C) was mailed to each subject in order to determine his or her attitudes toward various aspects of the training program. A total of 145 questionnaires were sent; 116 were completed and returned by mail. The number of completed questionnaires and the percentage return rate, by groups, is reported in Table 31.

Table 31. Questionnaire Return Rate

	IMM8	IMM4	IMM2	IMM1	DEL8	DEL4	DEL2	DEL1	TOTAL
Returned Questionnaires	19	15	14	18	12	11	14	13	116
Return Rate (%)	90	83	68	86	75	61	88	81	80

Overall, the groups were adequately represented by the returned questionnaires. With the exception of the 4-test delayed feedback group (DEL4), more than three-quarters of the questionnaires were returned by each group.

Reactions to Testing

Subjects were asked their opinion about the frequency of module testing and the length of the module test(s).

Table 32 presents the response to the question:

In my opinion, the testing was conducted

_____ too frequently

_____ about right

_____ not frequently enough.

Table 32. Opinions on Test Frequency[a]

OPINION	IMM8	IMM4	IMM2	IMM1	DEL8	DEL4	DEL2	DEL1	TOTAL
Too frequent	11	13	14	11	58	36	21	15	20.7
About right	89	80	64	67	42	64	50	54	65.5
Not frequent enough	0	7	21	22	0	0	29	31	13.8

[a] Results are expressed in percentages. Column totals not equal to 100% are due to missing data.

Subjects were also asked for their opinion of the length of the module tests which they had received. In response to the question:

I felt the tests were

_____ too long

_____ about the right length

_____ too short

the following results were obtained (Table 33).

Table 33. Opinions on Test Length[a]

OPINION	IMM8	IMM4	IMM2	IMM1	DEL8	DEL4	DEL2	DEL1	TOTAL
Too long	0	0	29	28	0	18	43	31	18.1
About right	100	93	71	72	100	82	57	62	80.2
Too short	0	0	0	0	0	0	0	8	0.9

[a] Results are expressed in percentages. Column totals not equal to 100% are due to missing data.

In general, subjects appeared to be satisfied with the frequency with which they received module tests; however, subjects in the delayed feedback groups were less satisfied with the frequency of the tests they received than the groups receiving immediate feedback. For example, 58% of the responses from the 8-test delayed feedback group stated that testing had been conducted too frequently; this opinion was not indicated by the subjects in the 8-test immediate feedback group (11% of the responses). About one-quarter of the subjects who received one or two module tests reported that the testing was not conducted frequently enough. Chi-square analysis[1] of the responses to the question on test frequency indicated that differences between the immediate and delayed feedback groups were not independent ($x^2 = 8.19$, df = 2, $p < .05$).

In terms of test length, respondents appeared to be more satisfied with shorter tests. All of the respondents in the 8-test groups indicated that they felt the module tests were about the right length. As tests became longer, dissatisfaction with the length of the test appeared to grow stronger. More than one-quarter of the subjects who received one or two module tests reported that the tests were too long. Chi-square analysis indicated that the immediate and delayed feedback groups were independent with regard to their attitudes toward test length ($x^2 = 3.41$, df = 2, $p > .05$).

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[1] Chi-square analyses were conducted using the DERS program, NONP15, Chi Square Test for Independence (Two and Three Way).

Reactions to Feedback

In order to determine subjects' opinions about the feedback they received on module tests, the following question was asked:

The feedback I received on the lesson test(s) was

_____ very useful

_____ somewhat useful

_____ not useful.

Responses to this question appear in Table 34 below.

Table 34. Opinions on Usefulness of Feedback[a]

OPINION	IMM8	IMM4	IMM2	IMM1	DEL8	DEL4	DEL2	DEL1	TOTAL
Very useful	42	13	43	61	17	27	29	38	35.3
Somewhat useful	47	73	36	33	67	55	43	46	49.1
Not useful	5	7	21	6	8	18	21	0	10.3

[a] Results are expressed in percentages. Column totals not equal to 100% are due to missing data.

Overall, subjects appeared to be satisfied with the feedback they received on the module tests. In all groups, more than three-quarters of the respondents indicated that the feedback they received was "very useful" or "somewhat useful".

Delayed feedback did not appear to affect the perceived usefulness of the feedback. Of those respondents indicating that the feedback was "not useful", immediacy of feedback did not appear to be the issue. There was no significant association between the immediate feedback and delayed feedback groups in terms of their dissatisfaction with the feedback they received ($\chi^2 = 1.66$, df = 2, $p > .05$).

However, test length may have influenced how subjects perceived the usefulness of feedback they received. Within both 2-test groups, 21 percent of the subjects indicated that the feedback they received was not useful. The length of the test may have interfered with the perceived usefulness of the feedback for these subjects, however, subjects who received only one test did not report similar dissatisfaction with their module test feedback.

Module Quality

In order to ascertain subjects' perceptions of the instructional quality of the CAI modules, subjects were asked about the quality of the modules; whether they thought the modules had helped them do better on the module test(s); whether, prior to the training program, they had routinely done the modules before attempting the module test; and whether, as a result of their experience with this training program, they would continue to study the CAI modules in the future.

Table 35 reports the responses to the question:

The overall quality of the lessons was

_____ excellent
_____ good
_____ satisfactory
_____ poor
_____ very poor.

Table 35. Instructional Quality [a]

OPINION	IMM8	IMM4	IMM2	IMM1	DEL8	DEL4	DEL2	DEL1	TOTAL
Excellent	11	7	14	6	0	0	0	31	8.6
Good	74	60	50	83	67	45	64	54	56.0
Satisfactory	16	27	36	6	25	45	21	15	22.4
Poor	0	0	0	6	0	9	7	0	2.6
Very poor	0	7	0	0	0	0	0	0	0.8

[a] Results are expressed in percentages. Column totals not equal to 100% are due to missing data.

Clearly, subjects felt that the quality of the CAI modules was adequate. More than 90% of the respondents in each group indicated that the modules were satisfactory, good, or excellent. There was no significant association between the immediate and delayed feedback groups regarding the instructional quality of the CAI modules (x^2 = 2.41, df = 4, $p > .05$).

Responses to the question "Do you think the lessons helped you do better on the tests?", are reported in Table 36.

Table 36. Helpfulness of CAI Modules for Module Tests[a]

OPINION	IMM8	IMM4	IMM2	IMM1	DEL8	DEL4	DEL2	DEL1	TOTAL
Modules helped	89	93	86	100	92	82	79	85	88.8
Modules did not help	11	7	14	0	0	18	14	0	7.8

[a] Results are expressed in percentages. Column totals not equal to 100% are due to missing data.

As Table 36 indicates, subjects appeared to feel that the CAI modules were useful. More than three-quarters of the respondents in each group stated that they felt that the CAI modules had helped them do better on the module tests. There was no significant association between the responses from the immediate and delayed feedback groups (x^2 = 0.46, df = 1, $p > .05$).

Prior to this training study, members of the CXPD had been given the option of not doing the CAI module before taking the module test. As the responses to the question below indicate, many subjects had not regularly completed the CAI modules before taking the respective module test.

The responses to the question: "Before this training program, did you normally do the introductory lessons?", are presented in Table 37.

Table 37. Subjects Who Routinely Completed Modules Prior to Training Program[a]

OPINION	IMM8	IMM4	IMM2	IMM1	DEL8	DEL4	DEL2	DEL1	TOTAL
Always	47	47	36	50	58	36	21	54	44.0
Sometimes	32	40	29	22	17	45	36	15	29.3
Never	21	13	36	28	17	18	36	31	25.0

[a] Results are expressed in percentages. Column totals not equal to 100% are due to missing data.

In order to determine whether subjects would continue to complete the CAI modules prior to attempting the module test, the question, "Will you do the introductory lessons from now on?", was asked. The responses to this question are reported in Table 38.

Table 38. Subjects Who Plan to Complete Modules in Future[a]

OPINION	IMM8	IMM4	IMM2	IMM1	DEL8	DEL4	DEL2	DEL1	TOTAL
Will complete	58	53	36	67	75	36	50	69	56.0
Will probably complete	42	40	43	28	17	64	29	31	36.2
Will not complete	0	0	21	6	0	0	14	0	5.2

[a] Results are expressed in percentages. Column totals not equal to 100% are due to missing data.

Comparison of Tables 37 and 38 provides evidence of the instructional quality of the CAI modules. The results indicate that many respondents who did not study the CAI modules prior to this training program, have changed their opinion of the usefulness of these modules, and plan to complete the CAI modules before attempting module tests in the future. Chi-square analysis indicated that the responses to these two questions were not significantly associated for the immediate and delayed feedback groups.

Attitudes Toward Computer-Based Training

Several questions were asked in order to determine subjects' attitudes toward computer-assisted instruction in general. Responses to the question, "Do you think that computer-based training is an effective way to learn?", are reported in Table 39 below.

Table 39. Perceived Effectiveness of CAI[a]

OPINION	IMM8	IMM4	IMM2	IMM1	DEL8	DEL4	DEL2	DEL1	TOTAL
Effective	89	93	79	83	92	82	71	100	86.2
Not effective	11	7	21	11	0	18	21	0	11.2

[a] Results are expressed in percentages. Column totals not equal to 100% are due to missing data.

The results obtained to the question, "Do you enjoy learning this way?", are presented in Table 40.

Table 40. Enjoyment of CAI[a]

OPINION	IMM8	IMM4	IMM2	IMM1	DEL8	DEL4	DEL2	DEL1	TOTAL
Enjoyable	84	87	57	83	83	64	64	85	76.7
Not enjoyable	11	13	43	11	8	36	29	15	19.8

[a] Results are expressed in percentages. Column totals not equal to 100% are due to missing data.

Chi-square analysis indicated no significant association between immediate and delayed feedback groups with regard to their perceived effectiveness of CAI ($\chi^2 = 0.06$, df = 1, $p > .05$) nor for their enjoyment of CAI ($\chi^2 = 0.29$, df = 1, $p > .05$).

Complete satisfaction with computer-assisted instruction was not readily apparent in the responses. At least 70% of the respondents in each group indicated that computer-assisted instruction was an effective way to learn. However, although these respondents may feel it is effective, whether they like it is open to debate. Within some groups, up to 43% of the subjects reported that they did not enjoy learning via computer-assisted instruction.

Discussion

The analysis of the responses to the questionnaire indicated mixed attitudes toward the training program and toward computer-based training in general. Overall, subjects appeared to be satisfied with the quality of the CAI modules and the feedback to the module tests they received. There were mixed opinions about the length and frequency of the module tests, however. Subjects in the more frequently tested groups tended to feel that the testing had been conducted too frequently. Subjects in the less frequently tested groups tended to feel that the tests they received were too long.

It was felt that subjects in the delayed feedback groups may have had more negative attitudes toward the training program than subjects who received immediate feedback because of the additional requirement imposed on them to pick up their feedback the day after testing occurred. With the exception of attitudes toward test frequency, however, statistical analysis indicated that the attitudes of the delayed feedback groups were no different than those of the immediate feedback groups.

In a training environment, positive attitudes as well as effective instruction are necessary for successful learning (Kearsley, 1985). The results of the questionnaire analysis indicate that attitudes toward training may not be completely positive. Nearly 20 percent of the respondents indicated that they did not enjoy learning via the computer, however, 86 percent of the respondents did indicate that CAI was an effective way to learn.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

Introduction

Testing and feedback are essential elements of any learning system. Without testing, learning cannot be measured; without feedback, learners cannot gauge their performance nor remediate their learning.

The study reported herein was conducted in order to investigate the effects of test frequency and immediate versus delayed feedback upon achievement and retention of knowledge. As noted in Chapter 2, little research has been done in the area of testing frequency. Most of the relevant research has addressed the Delay-retention Effect, i.e., contrasting the effects of immediate and delayed feedback on achievement and retention. These studies have been done primarily within classrooms or laboratory settings; little research has been done using computer-managed or computer-assisted instruction to present testing and feedback. Furthermore, none of the research regarding test frequency or feedback delay has addressed longer-term retention of knowledge.

In recognition that more empirical exploration of the nature of testing and feedback was necessary, the following research questions were addressed within the context of a CAI-based training program for police force members:

1. Does more frequent testing improve achievement and retention? What is the relationship between frequency of testing during training, and achievement and retention? Which testing frequency provides optimal achievement and retention?

2. Does immediate test feedback produce higher achievement test scores than test feedback delayed 24 hours? Does 24-hour delayed test feedback produce higher retention test scores than immediate feedback?

To answer these questions, several testing and feedback strategies were used and the effects of these strategies on achievement and retention test scores were studied.

Conclusions

The conclusions presented below must be interpreted in light of the somewhat small, although significant, differences which were found among the pretest, achievement test, and retention test measures. All groups showed significantly higher test score means on the achievement and retention tests administered after the completion of the four-month training program, in comparison to the mean scores on the pretest conducted prior to training. However, although these differences were statistically significant ($p < .05$), in real terms the increase between the pretest and achievement test scores was only 6.5 percent. When the data for the recruits was excluded from the analysis, the increase was only 4.9 percent. There was a negligible decrease (less than 1%) between the achievement test and the retention test. From a positive standpoint, however, this difference demonstrates that the amount learned, as measured by the two posttest measures, was sustained. Although the initial differences were not dramatic, test performance did not diminish over time. The mean scores of a retention test administered 10 weeks after the completion of the four-month training program were not significantly different than the achievement test score means. In fact, two groups had slight, non-significant gains between the achievement test and retention test.

Nevertheless, given the slight overall gains between the pretest and posttest measures, one has to question the efficacy of such an instructional approach. Indeed, how much learning actually took place as a result of the computer-based training program itself? For example, if a mastery-based model (80% passing grade) had been in place during this training program, 94% of the subjects would have failed to achieve mastery on the pretest. Following training, based on the results of the achievement test, 81% of the subjects would have failed to achieve mastery. On the retention test, 85% of the subjects would not have attained mastery. Although this study did not utilize a mastery-based model, the module test score means indicated that seven of the eight groups achieved mastery (i.e., had mean scores of 80% or greater). These results, however, were not reflected in the mean achievement or retention test scores. Furthermore, in addition to the CAI modules, subjects may have gained knowledge through their day-to-day work experience over the duration of this training program which was reflected in the posttest gains.

Clearly, a mastery-based training model, which uses testing until a criterion is reached, is more appropriate than the one-test training model used in this study. In police force training where issues of personal safety and proper administration of the legal system are crucial, mastery-based training is critical.

Frequency of Testing

The results of this study indicate that frequent testing appeared to result in significantly higher test scores on the tests taken within the training program itself. However, these increases were not sustained over time, and upon completion of the training program, these higher differences were no longer apparent. In other words, groups receiving frequent tests throughout the training program had higher test score means on the module tests they took as part of the training program. These increases were not evident on the achievement test conducted three days following the completion of the training program, nor on the retention test administered 10 weeks later, however.

Although frequent testing did not appear to affect achievement and retention, it did affect the amount of time needed to complete the training program. Frequent testing resulted in reductions in training time in the order of 25 to 33 percent in comparison with infrequent testing. Given that efficiency is often an essential criteria of a successful training program, these findings may be important.

In summary, an optimal training program is both effective and efficient. It produces meaningful learning in the least amount of time. Given these criteria, frequent, short tests, i.e., testing after each module of instruction, is the optimal training strategy. In this study, the effectiveness criterion was not demonstrated statistically. Although testing after every module appeared to result in higher test scores within the training program, these increases were not sustained when the posttest measures were administered. However, increased efficiency was associated with frequent testing; this was clearly demonstrated in this study. Significant reductions in training time resulted when tests occurred after each module.

Immediate Versus Delayed Test Feedback

There was no indication of a Delay-Retention Effect in the results of this study. Contrary to the DRE hypothesis, groups receiving 24-hour delayed feedback did not have higher retention test scores than groups receiving immediate feedback. Rather, all groups, regardless of the type of feedback received, showed negligible differences between achievement and retention test scores. Only two groups had higher retention test scores in comparison to their achievement test scores; both groups had received immediate feedback.

Like other studies of DRE which utilized computer-assisted instruction (e.g., Sheridan, 1980), this study failed to elicit a Delay-Retention Effect. There are several potential explanations for this result. First, the instructional content may have been too familiar to the subjects and, as a result, the gains between the pretest and initial posttest may have been attenuated. Second, because the content was familiar and frequently used in the subject's daily work, the posttest differences may have been similarly affected. Third, the instruction may not have been intensive or extensive enough to elicit a Delay-Retention Effect. Subjects in this study completed approximately three hours of training over a four-month period of time.

Another explanation may be in the nature of computer-based training. Unlike classroom-based instruction, exposure to computer-based instruction instills in learners the expectation of receiving immediate feedback to their responses. By imposing a time delay between the learner's response and the corresponding feedback, a form of dissonance or interference may have resulted. This result may have served to reduce or eliminate the advantageous effects of delayed feedback which are evident in classroom-based or laboratory-based studies. In these settings, delayed feedback falls within the learners' expectations. In an interactive computer-based setting, however, learners expect immediate feedback to their responses; delayed feedback may interfere with their learning, not enhance it.

However, although 24-hour delayed feedback did not affect achievement or retention, it did affect the amount of time needed to complete the tests. The study indicated that subjects who received their test feedback 24 hours later, spent more time taking tests than those who received immediate feedback. These results are important, especially when considering that testing time, as measured in this study, did not include the time that the delayed feedback groups spent studying the feedback 24 hours later nor the time they spent travelling to receive their feedback. Had this time been included as well, total training time would have been even greater for the groups receiving delayed feedback.

In conclusion, based on the results of this study, testing after each module coupled with immediate feedback clearly provides the most efficient training strategy. And, in comparison with the other training strategies examined, it is also as effective.

Recommendations

This study has produced several questions and observations which should be considered when assessing the results of this study and planning further research in this area.

First, the Delay-Retention Effect should be further explored within the context of computer-based instructional systems. At the present time there is little evidence of this phenomenon in computer-assisted instruction, and in actual training environments.

Second, training costs need to be identified. In this study, efficient training was defined using only the measure of time. The absence of a cost measure is notable. Further study is needed to determine the cost of each percentage point gain in training.

Third, although the percentage gains evident upon completion of the training program were small, these small gains may be considered important, as well as statistically significant. Further study is needed to identify minimum performance criteria, as measured by testing, and to determine whether these criteria were indeed met.

Finally, length of employment with the police department indicated significant differences among the pretest and posttest measures. In particular, recruits, 1-year members, and those with 16 or more years of police department experience had significantly lower mean pretest and posttest scores in comparison with the other groups. A much larger sample would have been necessary to determine the most effective testing and feedback strategy for each of the categories of length of employment. The results of this study indicate that these groups are different. Whether their training needs are different, or whether there are optimal training strategies for these groups, is an area requiring further study.

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APPENDIX A

MODULE PERFORMANCE OBJECTIVES

Arrest Review 1987

1. Identify the five duties of a Police Officer in making an arrest.

2. Identify the powers of arrest of any person as found in the Criminal Code.

3. Identify the powers of arrest afforded Police Officers as found in the Criminal Code.

Search Review 1987

1. Identify the common law powers of search.

2. Identify the commonly used statutory powers of search without warrant afforded Peace Officers in criminal law.

3. Identify the five requirements of an Information to Obtain a Search Warrant.

Appearance Notices

1. Identify the legal authorities to issue Appearance Notices as found in the Criminal Code.

2. Identify the Appearance Notice procedures as found in the City X Police Department Operations Manual.

3. Identify the identification procedures to be followed when issuing an Appearance Notice.

Laws of Evidence

1. Identify the requirements of and forms of:

    a. direct evidence;
    b. circumstantial evidence;
    c. best evidence;
    d. corroboration.

2. Identify the rules and exceptions of character evidence and opinion evidence.

3. Identify the rules and exceptions of hearsay evidence.

Elements of Crime

1. Identify the three forms of Actus Reus.
2. Identify the three forms of Mens Rea.
3. Identify the four statutory defenses available to an accused.
4. Identify the three Common Law defenses available to an accused.

Public Order Offences

1. Identify the elements of an unlawful assembly (Sec. 64, C.C.) and a riot (Sec. 65, C.C.).
2. Identify the elements of the charges, Obstructing a Peace Officer (Sec. 118, C.C.) and Public Mischief (Sec. 128, C.C.).
3. Identify the elements of the charges, Causing a Disturbance (Sec. 171, C.C.) and Trespassing at Night (Sec. 173, C.C.).

Operate While Impaired

1. Identify the elements of the following charges:
    a. Operate While Impaired (Sec. 237(a) C.C.);
    b. Operate While Impaired Causing Bodily Harm (Sec. 239(2) C.C.);
    c. Operate While Impaired Causing Death (Sec. 239(3) C.C.).
2. Identify the elements of the charge Operating a motor vehicle with more than 80 mg. alcohol in the blood, Sec. 237(b) C.C.
3. Identify the elements of the following:
    a. Breathalyzer Demand (Sec. 238(3)(a) C.C.);
    b. Blood Sample Demand (Sec. 238(3)(b) C.C.);
    c. Refusal Legislation (Sec. 238(5) C.C.).
4. Identify the elements of the ALERT legislation, Sec. 238(2) C.C.

Criminal Driving Offences

1. Identify the elements of the following charges:

   a. Dangerous Operation (Sec. 233(1) C.C.);
   b. Dangerous Operation Causing Bodily Harm (Sec. 233(3) C.C.);
   c. Dangerous Operation Causing Death (Sec. 233(4) C.C.).

2. Identify the elements of the charge, Hit and Run (Sec. 236(1) C.C.).

3. Identify the elements of the charge, Operating While Disqualified (Sec. 242(4) C.C.).

APPENDIX B

INSTRUCTIONS TO SUBJECTS

Welcome to the Research Project on Computer-Based Training. As a participant, you will be involved in helping to investigate the best and most efficient way to conduct future training in the Police Department.

Over the next four months, you will complete eight training modules. During this period you will be exempt from meeting monthly training requirements and locked out of access to your regular training group. On the attached card you will find your PLATO I.D. and group name to be used for the duration of this project.

At the beginning of this research project you will write a pretest. This test is for research purposes only and will have no bearing on your results.

Module "introductory lessons" must be completed and will require about 15 - 30 minutes to complete. The corresponding test after each lesson, or series of lessons, may be taken during the same session.

Tests are closed book, that is, you may not refer to videotapes, the Criminal Code, or notes of any kind during the test session. You will have one attempt at each test.

The modules will be delivered on the PLATO computer terminals at the rate of one every two weeks according to the following schedule.

1. Arrest Review 1987	January 5 - January 25
2. Search Review 1987	January 26 - February 8
3. Appearance Notices	February 9 - February 22
4. Laws of Evidence	February 23 - March 8
5. Elements of Crime	March 9 - March 22
6. Public Order Offences	March 23 - April 5
7. Operate While Impaired	April 6 - April 19
8. Criminal Vehicle Offences	April 20 - May 3

At the end of the training period, there will be a post-test and a follow-up test. It is important that you complete the modules and tests according to the attached schedule.

Terminal Locations and Availability

PLATO terminals are available at HQ (Room 520) and Division from 0100 to 2300 hours Monday through Saturday and from 1200 to 2000 hours on Sunday.

In addition, access to terminals at (a central PLATO installation) has been arranged. Officers wishing to work on these terminals to complete the pre-test and the first module may go to (address). Terminals are available:

0830 to 2030 Monday through Thursday
0830 to 1630 on Friday, and
1300 to 1700 on Sunday.

If you have any questions or foresee any scheduling problems, e.g., holidays, sickness, transfers, please contact the Training Section office immediately:

Training Schedule

PLATO Group del218
(8 lessons, 8 tests, delayed feedback)

	Complete the lesson/test by	Test will require approximately
Pre-Test	January 18	1 hour
Arrest Review 1987	January 25	15 minutes
Search Review 1987	February 8	15 minutes
Appearance Notices	February 22	15 minutes
Laws of Evidence	March 8	15 minutes
Elements of Crime	March 22	15 minutes
Public Order Offences	April 5	15 minutes
Operate While Impaired	April 19	15 minutes
Criminal Vehicle Offences	May 3	15 minutes
Post-test	May 10	1 hour
Follow-Up Test	Early August (TBA)	1 hour

To help you schedule your time, remember that each module lesson will require about 15 - 30 minutes to complete. The time required for each test is specified above. To avoid problems in accessing terminals, you are encouraged to complete the lesson/test well ahead of the stated completion date.

APPENDIX C

PRETEST, ACHIEVEMENT/RETENTION TEST, AND QUESTIONNAIRE

Pretest

1. When making an arrest which of the following must a Police Officer do?

   a) Handcuff the accused.
   b) Advise the subject about the "Police Charter".
   c) Tell the subject he has the right to remain silent.
   *d) Take physical custody of the subject.
   e) Tell the accused he will be assigned counsel.

2. You arrive at Mr. Jones´ office with a warrant to arrest him for an unpaid traffic summons. Confirming that the man in the office is indeed Mr. Jones, you place your hand on his shoulder, advise him he is under arrest, and tell him the reason. You then state, "You have the right to retain and instruct counsel without delay." Mr. Jones asks if he can call his lawyer on his office phone before he comes with you. What should you do?

   *a) Let Mr. Jones make the call to his lawyer.
   b) Tell him he can call as soon as you get to the station.
   c) Tell him that he can call as soon as he has been booked.
   d) Tell him you are in a hurry and will let him call as soon as you get time.

3. John is having a party at his home. A men yells at his girlfriend and shoves her, knocking her to the floor. He moves toward her again when John decides to step in and make a citizen´s arrest. Which one of the following would John rely on?

   a) Reasonable and probable grounds is about to commit an indictable offence.
   *b) Finds committing a criminal offence on or in relation to property.
   c) Finds committing a criminal offence.
   d) Reasonable and probable grounds has committed a criminal offence.
   e) Finds committing a summary conviction offence.

4. While on foot patrol you hear someone yelling. You turn and observe two women running one behind the other. The woman behind yells, "Stop her, she skipped out on her food bill." You stop the first woman as she approaches. Which of the following arrest powers do you rely on in this situation?

   a) Reasonable and probable grounds has committed an indictable offence.
   b) Reasonable and probable grounds has committed a criminal offence.
   *c) Reasonable and probable grounds has committed a criminal offence and is escaping from and freshly pursued by someone who may arrest her.
   d) Knows has committed a criminal offence.
   e) Finds committing a criminal offence.

5. Which of the following are a Peace Officer's power to arrest under Section 450 C.C.?

   *a) Finds committing a criminal offence.
   b) Finds committing an indictable offence.
   c) Reasonable and probable grounds has committed a criminal offence.
   *d) Reasonable and probable grounds has committed an indictable offence.
   e) Reasonable and probable grounds has committed a summary conviction offence.

6. You have been dispatched to a domestic complaint. As you are about to leave the very angry husband yells at his wife, "You'll be sorry you called the cops!". Which one of the following could apply in this situation?

   a) Arrest the husband on reasonable and probable grounds he is about to commit a summary conviction offence.
   b) Arrest the husband on reasonable and probable grounds he is about to commit a criminal offence.
   *c) Arrest the husband on reasonable and probable grounds he is about to commit an indictable offence.
   d) Leave the premises. (If he does assault her you can arrest on the re-call.)

7. The power to search an arrested person is found in

   a) statute law.
   b) civil law.
   *c) common or case law.
   d) tort law.

8. You observe two men making an exchange in a lane. One man receives money, the other a clear plastic bag containing packages wrapped in tin foil. Suddenly they see you. One runs down the street; the one with the bag runs into a house. You call for backup and then run after them. Which of the following would best resolve this situation?

   a) Knock on the door of the house, demand entry, and, if no one answers, enter by force.
   b) On your portable radio, call for the Drug Squad to respond with a Writ of Assistance.
   c) Return to your duties and try again tomorrow night.
   *d) Unannounced, enter the house immediately and search for the suspect.
   e) Watch the house until he comes out.

9. You have reason to believe that a quantity of controlled drugs from a drugstore B and E is being stored in John Smith's apartment. Which of the following statements is true?

   *a) You may not search without a warrant.
   b) You may search without a warrant if proper announcement procedure is followed.
   c) You may search without a warrant under Section 10 of the N.C.A.
   d) You may search without a warrant under Section 101(2) of the Criminal Code.
   e) You may not search without a warrant unless you intend to arrest John Smith for "Possession of Narcotic".

10. Which of the following laws allow you to search a person without his consent?

   *a) Common Law (following an arrest)
   b) Section 443 Criminal Code (Search warrant)
   *c) Section 99 Criminal Code (Firearms Offence)
   *d) Section 10 Narcotic Control Act
   e) Section 100 Criminal Code

11. Which of the following are legal requirements of an Information to obtain a Search Warrant?

    *a) description of items sought
    b) legal description of the property
    c) names of those believed to be involved
    d) recommended date for search
    *e) crime committed to obtain the items

12. An information to obtain a search warrant requires reasonable and probable grounds that

    a) an offence was committed.
    b) the accused committed the offence.
    c) the accused will be at the location to be searched.
    d) the items were obtained by commission of an offence.
    *e) the items will be found at the location.

13. An Appearance Notice is a

    *a) subpoena to an accused to appear in court and for fingerprinting.
    b) summons to an accused to appear in court and for fingerprinting.
    c) written notice to an accused to appear in court and for fingerprinting.
    d) court order to an accused to appear in court and for fingerprinting.

14. Which one of the following is a legal requirement of issuing an Appearance Notice?

    a) name of the complainant
    *b) identity of the accused
    c) statements made by the accused
    d) signature of the accused

15. When an Appearance Notice serial number ends in "3" the court date selected should be

    a) one week from the Monday next.
    b) three weeks from the Monday next.
    c) two weeks from the Tuesday next.
    *d) three weeks from the Tuesday next.

16. You are issuing an Appearance Notice to a person accused as an accessory after the fact of the commission of an indictable offence. He refuses to sign the Appearance Notice. You should

   *a) issue him a copy of the unsigned notice.
   b) insist that he sign and, if he continues to refuse, arrest him for "Obstructing a Peace Officer".
   c) issue a summons for the indictable offence of which he is accused.
   d) arrest him for the indictable offence of which he is accused.

17. When an Appearance Notice is issued requiring Identification processing, you shall

   a) indicate in the report that processing is required.
   *b) attach a "red urgent" tag to the report.
   c) forward the "ident" copy of the Appearance Notice to the Criminal History Unit.
   d) notify your immediate supervisor who will then contact the Criminal History Unit.

18. The identification processing of an Appearance Notice issued to one or more persons, when at least one or more persons are arrested at the same incident, will occur

   a) between 8:00 A.M. and 8:00 P.M. one week after the issuing date.
   b) between 8:00 A.M. and 8:00 P.M. three weeks after the issuing date.
   *c) at 8:00 A.M. on the court date of the arrested person.
   d) between 2:00 P.M. and 10:00 P.M. on the court date of the arrested person.

19. Which one of the following best describes Circumstantial Evidence?

   a) It is evidence derived from one's senses.
   b) It is entered only after the accused testifies.
   *c) It is evidence that causes an inference of guilt.
   d) It can be entered by the defense only.
   e) It is accepted in indictable offences only.

20. Which one of the following is an example of Best Evidence?

    a) a photo of the murder weapon
    b) a signed statement of a witness to the murder
    c) a copy of the breathalyzer certificate
    *d) a photo of the murder scene
    e) a witness describing what another witness saw at the scene

21. Peace Officers should give opinion evidence when

    *a) asked for it.
    b) required by law.
    c) required by practice.
    d) character is an issue.
    e) the opportunity arises.

22. At the conclusion of an Operate While Impaired trial the Crown asks the officer to describe the conditions that caused him to form a conclusion of the accused´s ability to operate a vehicle. What kind of evidence will the officer then attempt to enter?

    a) direct evidence
    *b) opinion evidence
    c) character evidence
    d) circumstantial evidence
    e) expert evidence

23. Informing the court that you received a radio call to respond to the scene of a murder is an example of which kind of evidence?

    a) opinion evidence
    b) expert evidence
    c) best evidence
    *d) hearsay evidence
    e) character evidence

24. Hearsay evidence is not accepted because

    a) the accused did not testify on his own behalf.
    b) it is character evidence and therefore is not admissible.
    *c) the meaning of the original speaker is not measurable.
    d) it is opinion evidence and should not be given unless requested.

25. Which of the following are forms of Actus Reus?

 a) thoughtless actions deserving punishment
*b) a physical act prohibited by law
 c) automatism
*d) an omission to perform a legal duty
*e) a condition prohibited by law

26. Which of the following are "physical acts prohibited by law"?

 a) drunkenness
*b) assault with a weapon
 c) operate while impaired
 d) failure to provide a breath sample
*e) murder

27. Which of the following are forms of Mens Rea?

 a) automatism
*b) negligence
 c) compulsion
*d) intention
 e) mistake of fact

28. Willie and Mike are walking along a cliff's edge. Willie sees a $100 bill on the ground ahead. He runs for the bill and bumps Mike causing Mike to fall over the edge. What form of Mens Rea does this illustrate?

 a) compulsion
 b) recklessness
 c) intention
 d) automatism
*e) negligence

29. The Limitation of Action for Federal Summary Conviction offences is

*a) 6 months
 b) 1 year
 c) 1 year, 6 months
 d) 7 years
 e) there is no limitation of action

30. Which statement is true?

    a) Limitation of Action does not apply to indictable offences.
    b) Compulsion may be used as a defense to Abduction Offences but not to Sexual Assault.
    c) There is no Limitation of Action for most summary conviction offences.
    *d) Insanity must be proven by the defense before it can render an accused person not responsible.

31. Willie and Mike are given a pair of tickets to the hockey game Friday night. At the game, they are arrested. The tickets they were given, it turns out, were stolen eight months ago. They would likely use which common law defense to avoid being convicted?

    a) automatism
    b) negligence
    *c) mistake of fact
    d) limitation of action

32. From the following list select those that are common law defenses.

    *a) automatism
    b) insanity
    *c) mistake of fact
    d) limitation of action
    e) ignorance of the law

33. Which of the following are elements of an Unlawful Assembly?

    a) twelve or more persons
    *b) gathering for a common purpose
    c) with intent to alarm
    *d) conducting themselves in a manner
    e) has begun to disturb the peace tumultuously

34. You are called to a downtown park concerning a disturbance complaint. As you arrive, a group of about 150 youths are around a large fire and ten picnic tables have been thrown on the fire. Several youths begin shouting "Pigs, pigs" and throwing beer bottles at the police vehicle. The rest of the group are shouting encouragement and gathering more bottles. Sixty of the youths are apprehended. Which charge(s) would be appropriate for these circumstances?

 a) Obstruction of Justice and Mischief
*b) Riotous Behavior and Mischief
 c) Riotous Behavior and Public Mischief
 d) Being a Member of an Unlawful Assembly
 e) Being a Member of an Unlawful Assembly and Mischief

35. Which of the following are elements of the charge, Obstructing a Police Officer?

*a) willfully
 b) with intent to deceive
*c) resists or obstructs
 d) endangering human life
 e) falsely reporting the commission of an offence

36. You are investigating a hit and run accident involving a car and pole. The driver has left the scene and his car behind. A stolen vehicle investigation reveals the vehicle as reported stolen by the owner. You complete the investigation and later learn of a witness to the accident. Her description of the driver matches the owner. You confront the owner with your findings and he admits he was driving. Which of the following would best describe the situation?

*a) Public Mischief
 b) Mischief Under $1000
 c) Obstructing Justice
 d) Obstructing a Peace Officer
 e) Being Unlawfully at Large

37. You are called out to investigate a "Peeping Tom" complaint. You apprehend an 18-year-old youth in the front yard of the complainant's property. In order to insure a conviction for Trespassing At Night, you should

 a) find out if the youth lives nearby.
*b) demand an explanation for his presence there.
 c) find out if the suspect has been previously convicted of a similar offence.
 d) ask the complainant to positively identify the youth as the one he had reported peeping.
 e) issue the suspect an Appearance Notice for Trespassing At Night and take a statement immediately.

38. Which of the following are elements of the charge Trespassing At Night?

*a) at night (9:00 P.M. to 6:00 A.M.)
 b) at night (10:00 P.M. to 7:00 A.M.)
 c) in or near a public place
 d) not being in a dwelling house
*e) upon the property of another

39. Which of the following are elements of the charge Operate While Impaired, Section 237(a) C.C.?

*a) has care or control of a motor vehicle
 b) reasonably suspects
 c) alcohol in his blood
*d) whether or not in motion
 e) having exceeded the legal limit
*f) while ability to operate
 g) willfully

40. To convict for Operate While Impaired, the suspect must have a blood alcohol level over

 a) 80 mg. per 10 millilitres of blood
 b) 80 mg. per 100 millilitres of blood
 c) 80 mg. per 1000 millilitres of blood
*d) blood alcohol level is not pertinent to the charge

41. Which of the following are elements of the charge, Operating a Motor Vehicle with more than 80 mg. of alcohol in blood, Section 237(b) C.C.?

a) impaired by alcohol or drug
*b) operates a motor vehicle
*c) having consumed alcohol
d) fails or refuses to comply
e) without reasonable excuse
*f) in motion or not
g) reasonably suspects

42. A motorist may be charged with Operating a Motor Vehicle with more than 80 mg. of alcohol in blood

a) after failing an ALERT test.
b) after both an ALERT and breathalyzer/blood/urine test are conducted.
*c) after a breathalyzer/blood/urine test is conducted.
d) when there are obvious physical signs of impairment.

43. Which of the following are elements required to make a breathalyzer Demand under Section 238(3)(a) C.C.?

*a) reasonable and probable grounds
*b) an offence of Operate While Impaired or Over 80 mg.
c) reasonably suspects
d) having consumed alcohol
*e) is being committed or has been committed within the preceding two hours
f) while his ability to operate is impaired by alcohol or drug

44. Following a single vehicle collision the suspect driver is taken to hospital with minor injuries. You determine that he was Operating While Impaired. The driver is conscious but will be admitted for observation and is incapable of providing breath samples. What should be done now?

a) Try to convince the medical staff to make him available for breathalyzer test.
b) Call your supervisor to respond, with an ALERT device to the hospital immediately.
c) Arrest the driver for Operate While Impaired and get a warrant to have blood taken.
*d) Arrest the driver for Operate While Impaired, advise of right to counsel, and make a demand for blood samples.
e) Arrest the driver for Operate While Impaired and charge him with failing to provide breath samples.

45. In order to make an ALERT demand a Police Officer should

a) believe the suspect is impaired.
*b) reasonably suspect alcohol is present in the person's body.
c) believe the suspect has blood alcohol over 80 mgs.
d) have received a refusal by the accused to provide samples of breath or blood.

46. You have just administered an ALERT test and the driver has failed. What should be done now?

a) Re-test to confirm reading.
b) Check for other signs of impairment.
c) Arrest for Failing an ALERT test, Section 238(5) C.C.
d) Make a breathalyzer/blood demand on grounds he is operating while impaired.
*e) Arrest for Operating a Motor Vehicle with Over 80 mg. alcohol in blood and make a breathalyzer demand.

47. Which of the following are elements of Dangerous Operation, Section 233(1) C.C.?

a) involved in an accident with a person, vehicle or cattle in charge of a person
*b) on a street, road, highway or other public place
c) causes bodily harm
*d) in considering nature, condition, and use of the place
e) with intent to escape civil or criminal liability

48. You are investigating a fatal motor vehicle accident. The offending vehicle failed to stop for a red light striking the deceased's vehicle. Investigation reveals that the brakes on the offending vehicle were worn out. The owner had been warned by his mechanic not to drive the vehicle. Which of the following charges should be laid?

a) Red Light Violation under H.T.A.
b) Dangerous Operation, Section 233(1)(a) C.C.
c) Careless Operation under H.T.A.
*d) Dangerous Operation Causing Death, Section 233(4) C.C.
e) No charge due to misadventure of brake failure

49. Which of the following are elements of the charge, Hit and Run, Section 236(1) C.C.?

a) on a street, road, highway or public place
b) traffic is present or expected to be present
*c) with intent to escape civil or criminal liability
d) fails to assume his financial responsibility
*e) having care, charge or control of a vehicle

50. You locate a suspect at his home who has left his car at the scene of a hit and run vehicle collision. What should you do?

*a) Ask him why he left the scene.
b) Arrest him for Hit and Run.
c) Issue an Appearance Notice for Hit and Run.
d) Arrest him for Dangerous Driving Causing Death.

51. Mandatory disqualification will follow a conviction for which of the following?

a) Dangerous Operation
b) Dangerous Operating Causing Death
*c) Operate While Impaired
*d) Operate While Over 80 mg.
e) Careless Driving H.T.A.

52. The charge, Operating a Motor Vehicle While Disqualified, requires that

a) the disqualification has been made for a Criminal Code violation.
b) the disqualification has occurred in Alberta.
*c) the vehicle is being driven on public property.
d) the vehicle is being driven in an unsafe manner.

Achievement/Retention Test

1. When making an arrest, which of the following must a Police Officer do?

   a) Handcuff the accused immediately.
   b) Tell the subject he has the right to remain silent.
   *c) Identify yourself as a Police Officer.
   d) Transport the accused to detention as soon as possible.
   e) Tell the accused he will be assigned counsel.

2. You observe a vehicle weaving back and forth as it leaves the parking lot of a local hotel. Suspecting the operator may be impaired, you pull him over, converse, make a breathalyzer demand, and escort him before a breathalyzer. Which of the following applies?

   *a) You must inform him of his right to retain and instruct counsel without delay and allow him to exercise that right before he submits to a breathalyzer.
   b) You must inform him of his right to retain and instruct counsel but you are not obliged to let him exercise that right before the test.
   c) You are not required to inform him of his right to retain and instruct counsel without delay until after the breathalyzer.
   d) You are not required to inform him of his right to retain and instruct counsel as you suspect he is impaired.

3. John borrows his neighbor's car to go to the store for cigarettes. While in the store, he looks out the window to see a man break the mirror off the car and walk away. What power of arrest does John have, if any?

   a) finds committing a criminal offence
   *b) finds committing a criminal offence in relation to property
   c) finds committing a summary conviction offence
   d) breach of the peace to prevent renewal
   e) no power of arrest here

4. While on duty you hear someone yelling, "Stop her, she stole my wallet!". A garishly dressed young woman is being chased by a middle-aged man. You stop the woman as she approaches. Which of the following arrest-powers do you rely on in this situation?

   a) reasonable and probable grounds has committed a summary conviction offence
   b) reasonable and probable grounds has committed an indictable offence
   *c) reasonable and probable grounds has committed a criminal offence and is escaping from and being pursued by someone who may arrest her
   d) knows has committed a criminal offence
   e) finds committing a criminal offence

5. Which of the following are a Peace Officer´s power of arrest under Section 450 C.C.?

   *a) knows has committed an indictable offence
   b) knows has committed a criminal offence
   c) finds committing a summary conviction offence
   d) reasonable and probable grounds has committed a criminal offence
   *e) reasonable and probable grounds there is a warrant of arrest

6. You have been dispatched to a disturbance over a barking dog. As you are about to leave, you overhear the very angry dog owner say to his neighbor, "You´ll be sorry you called the cops when you find your cat dead!". Which one of the following would apply in this situation?

   a) Arrest the dog owner on reasonable and probable grounds he is about to commit a summary conviction offence.
   b) Arrest the dog owner on reasonable and probable grounds he is about to commit a criminal offence.
   *c) Arrest the dog owner on reasonable and probable grounds he is about to commit an indictable offence.
   d) Leave the scene. If he does kill the cat you can arrest on the re-call.

7. The power to search an arrested person is found in which of the following?

    a) Section 99 C.C.
    b) Section 443 C.C.
    *c) Common or Case law
    d) Civil law
    e) Charter of Rights and Freedoms

8. You receive information as to the whereabouts of a person wanted on a warrant for Theft Over $1000. You arrive and observe a vehicle registered to the wanted man parked at the rear. As you knock at the door, several lights go out in the house. You announce your presence and purpose. No response is made. Which of the following would best resolve the situation?

    a) Call for the arrest warrant.
    b) Leave and obtain a search warrant.
    c) Watch the house until you confirm that he is inside.
    d) Call for back-up, contain the area, and wait for him to come out.
    *e) Obtain back-up, enter the house (using force if necessary), and search for the accused.

9. You have reliable information that a quantity of illegal narcotics is stored in a warehouse in the west end. Which of the following is true?

    *a) You should obtain a search warrant before you search.
    b) You may search without a warrant under Common Law.
    c) You may search without a warrant only with the consent of the owner.
    d) You may search without a warrant only if you have arrested the owner.
    e) You may search without a warrant under Section 37 F.D.A.

10. Which of the following laws allow you to search a dwelling house or portion thereof without a warrant?

    a) Section 10 Narcotic Control Act
    b) Section 99 Criminal Code (Firearms Offence)
    c) Section 100 Criminal Code
    *d) Section 101(2) Criminal Code
    *e) Common Law (Consent)

11. Which of the following are legal requirements of an Information to obtain a Search Warrant?

    *a) description of items sought
    b) legal description of the property to be searched
    c) names of those believed to be involved
    d) recommended date for search
    *e) crime committed to obtain the items

12. Which of the following is a requirement of an Information to obtain a Search Warrant?

    a) Reasonable and probable grounds to believe an offence was committed.
    *b) Reasonable and probable grounds to believe the items will be found at the location.
    c) Reasonable and probable grounds to believe the accused committed the offence.
    d) Reasonable and probable grounds to believe the items were obtained by the commission of an offence.
    e) Reasonable and probable grounds to believe the accused will be at the location to be searched.

13. Which one of the following is a legal requirement of issuing an Appearance Notice?

    a) name of the complainant
    b) full description of the offence (the same as an information)
    *c) time and place for the accused to attend court
    d) signed (under penalty of arrest) in duplicate by the accused and a copy given to the accused

14. An Appearance Notice requires an accused to appear in court and for fingerprinting. It is issued in the form of a

    a) subpoena
    b) summons
    c) court order
    *d) written notice

15. The court appearance for an Appearance Notice which ends with an "8" is

 a) three weeks from Tuesday next.
 b) three weeks from Wednesday next.
*c) three weeks from Thursday next.
 d) three weeks from Friday next.

16. An accused refuses to sign an Appearance Notice for an indictable offence. You should

 a) arrest for "Obstructing a Peace Officer".
*b) give him a copy of the Appearance Notice anyway.
 c) arrest for the indictable offence for which the notice was being issued.
 d) issue a summons for the offence for which the notice was being issued.

17. The appearance time for "fingerprinting and photographing" on Appearance Notices is

 a) 8:00 A.M. to 4:00 P.M.
 b) 10:00 A.M. to 10:00 P.M.
 c) 2:00 P.M. to 10:00 P.M.
*d) 8:00 A.M. to 8:00 P.M.

18. When a young offender is issued an Appearance Notice requiring identification processing, you shall

*a) attach a "red urgent" tag to the report.
 b) indicate in the report that identification is required.
 c) forward the "ident" copy of the notice to the Juvenile Authorities.
 d) notify your immediate supervisor who will then contact the Juvenile Authorities.

19. Pubic hair matched to the accused and found at the scene of the crime is an example of what type of evidence?

 a) direct evidence
 b) opinion evidence
 c) character evidence
 d) hearsay evidence
*e) circumstantial evidence

20. Direct evidence is best described as

a) evidence required by law.
b) the only evidence the court will accept.
c) only evidence legislated in the Canada Evidence Act.
d) evidence from which an inference of guilt is drawn.
*e) evidence testified to because the witness was present.

21. A Peace Officer testifies that he found the accused hiding under a parked car. What kind of evidence is he presenting?

a) direct evidence
b) character evidence
c) circumstantial evidence
*d) opinion evidence
e) hearsay evidence

22. Which of the following is an exception to the Character Evidence Rule?

a) Do not offer character evidence unless asked for it.
b) Experts because of experience or training are allowed to offer character evidence.
*c) When the accused testifies on his own behalf under Section 12 Canada Evidence Act.
d) After a finding of guilt to assist in an adequate sentence.
e) When the accused testifies on his own behalf under Section 12 Criminal Code.

23. Which of the following are reasons why Hearsay Evidence is not accepted?

*a) lack of oath by original speaker
b) your opinion should not be given unless asked for
c) it must link the accused to the offence
d) the accused did not testify on his own behalf

24. You inform the court that you apprehended the accused when you heard the shopkeeper yell, "Stop him. He robbed me!". You are presenting what kind of evidence?

 a) opinion evidence
 b) expert evidence
 c) best evidence
*d) hearsay evidence
 e) character evidence

25. Which of the following are conditions prohibited by law?

*a) operate while impaired
*b) possession of stolen property
 c) failure to remain at the scene of a collision
 d) automatism
*e) being drunk in a public place

26. Which of the following are forms of Actus Reus?

*a) a state of affairs prohibited by law
 b) planning to commit an illegal act
*c) an omission to perform a duty required by law
 d) showing willful recklessness
*e) physical acts prohibited by law

27. In a charge of conspiracy, the Mens Rea is which of the following?

 a) the agreement to commit the offence intended
*b) the intention to commit the offence agreed to
 c) the commission of the offence intended and agreed to
 d) the offence itself
 e) the agreement itself

28. John and Bob are walking along Jasper Avenue. Bob sees an expensive watch lying by the curb. He lunges for the watch and bumps John who falls into the path of a speeding automobile. What form of Mens Rea is illustrated here?

 a) compulsion
 b) recklessness
 c) intention
 d) automatism
*e) negligence

29. The Limitation of Action for a Provincial summary conviction offence is

*a) 6 months.
b) 1 year.
c) 18 months.
d) 2 years.
e) There is no Limitation of Action.

30. Which statement is true?

a) Limitation of Action does not apply to indictable offences.
b) There is no Limitation of Action for most summary conviction offences.
c) Compulsion may be used as a defense to Abduction Offences.
*d) No person under 12 years of age may be convicted of an offence.

31. Willie is staying at Mike´s house. Coming in late one night, after an evening of heavy drinking, he creeps through the darkened living room trying to avoid waking the household. Mike´s dog, Buster, barks at Willie, startling him. Willie kicks the dog, injuring him severely. Mike awakes, a disturbance ensues, and Willie is charged with cruelty to animals. Which common law defense is most appropriate in this case?

a) automatism
b) compulsion
*c) drunkenness
d) negligence

32. Which of the following are common law defenses?

a) limitation of action
*b) mistake of fact
*c) drunkenness
d) insanity
e) ignorance of the law

33. Which of the following are elements of a Riot?

- a) 12 or more persons
- b) gathering with intent to disturb
- *c) has begun to disturb the peace tumultuously
- d) creating a disturbance
- *e) gathered for a common purpose

34. When is the Riot Proclamation read?

- a) when an Unlawful Assembly of 12 or more persons will not disperse
- b) when a Riot of three or more persons will not disperse
- *c) when a Riot of 12 or more persons will not disperse
- d) when 12 or more persons are gathered for a common purpose
- e) when a gathering of three or more persons has begun to disturb the peace tumultuously

35. Which of the following is an element of the charge Obstructing a Peace Officer?

- a) causes a Peace Officer to enter upon an investigation
- b) falsely reporting the commission of an offence
- c) ignoring the request of a Peace Officer
- *d) accused knew the Peace Officer was in fact a Peace Officer
- e) false statement accusing another of committing an offence

36. You begin to issue a summons to a motor vehicle operator. A passerby stops and tries to intervene on the driver´s behalf. The passerby repeatedly interrupts you and tells the driver not to cooperate with you. You warn the passerby to go about his business, but he ignores you and again tells the driver to leave and ignore you and your summons. Which of the following best describes the bystander´s situation?

- a) Mischief
- b) Public Mischief
- c) Common Nuisance
- d) Obstructing Justice
- *e) Obstructing a Peace Officer

37. You respond to a call reporting a prowler and apprehend a man hiding in the bushes in the back yard of the complainant's property. To insure a conviction for Trespassing at Night you should

 a) ask if he lives nearby.
*b) ask why he is there.
 c) issue him an Appearance Notice and take a statement.
 d) inform him of his rights and arrest him.
 e) ask him if he has ever been charged or convicted of a similar offence.

38. Which of the following are elements of the charge, Causing a Disturbance?

*a) in or near a public place
 b) upon the property of another
*c) not being in a dwelling house
 d) disturbing other persons
 e) at night

39. Which of the following are elements of the charge, Operate While Impaired, Section 237(a) C.C.?

 a) reasonably suspects alcohol
 b) with a blood/alcohol level over 80 mg.
*c) operates a motor vehicle
*d) while his ability to operate
 e) causes death of another person
*f) is impaired by alcohol or drug
 g) causes bodily harm to another person

40. A conviction for the charge, Operate While Impaired, requires that the accused have a blood alcohol level of

 a) .08 mg.
 b) .8 mg.
 c) 80 mg.
*d) Blood alcohol level is not pertinent to conviction.

41. Which of the following are elements of the charge, Operating a Motor Vehicle with more than 80 mg. alcohol in blood, Section 237(b) C.C.?

*a) has care or control of a motor vehicle
b) while his ability to operate
c) is impaired by alcohol or drug
*d) in motion or not
*e) having consumed alcohol
f) reasonably suspects
g) causes injury or damage

42. The charge, Operating a Motor Vehicle with more than 80 mg. alcohol in the blood, may be laid only

a) after an ALERT test is conducted.
b) after both an ALERT test and breathalyzer are conducted.
*c) after a breathalyzer test is conducted.
d) when the officer discerns obvious physical impairment.

43. Which of the following are required to make a Breathalyzer Demand under Section 238(3)(a) C.C.?

*a) reasonable and probable grounds
b) consumption of alcohol
c) ability to operate is impaired by alcohol or drug
*d) under the offence of Section 237 C.C.
*e) is committing now or has committed within the preceding two hours

44. You have determined through observation and sobriety tests that the driver is impaired. What should be done now?

a) Make an ALERT demand.
b) Arrest and make an ALERT demand.
*c) Arrest for Operate While Impaired and make a breathalyzer demand.
d) Seize his vehicle and caution about making statements.
*e) Advise him of his right to counsel.
f) Demand a blood sample.

45. You observe a vehicle drive over the curb while making a turn. You stop the driver and find no visible signs of impairment, however, there is a noticeable smell of alcohol on his breath. Which should you do?

*a) Make an ALERT demand without arrest.
b) Arrest, caution, advise of right, and make an ALERT demand.
c) Make a breathalyzer or blood test demand on the grounds he is impaired by alcohol or drug.
d) Make a breathalyzer or blood test demand on the grounds he is over 80 mg. alcohol in blood.
e) Charge with Operate While Impaired, issue an Appearance Notice, and release without his vehicle.

46. When should an ALERT demand be made to a motorist?

a) Only after an accident with another vehicle.
b) Only when there are visible signs of impairment.
c) Only when the suspect refuses a breathalyzer test.
d) Only when the suspect fails other sobriety tests.
*e) Only when the suspect shows no visible signs of impairment other than a smell of alcohol on his breath.

47. Which of the following are elements of Dangerous Operation, Section 233(1)(3) C.C.?

*a) operates a motor vehicle
b) causes bodily harm
c) involved in an accident with a person or vehicle
d) in a manner dangerous to the public
e) with intent to cause danger to the public

48. You are investigating a fatal motor vehicle accident. The offending vehicle is a motorcycle that went out of control when the front tire burst. Investigation reveals that both tires were badly worn showing no tread in several places. Which of the following should be laid?

a) Dangerous Operation, Section 233(1)(a) C.C.
b) Careless Driving under the H.T.A.
c) Driving With Undue Care and Attention under H.T.A.
*d) Dangerous Driving Causing Death, Section 233(4) C.C.
e) No charge due to misadventure of tire blowout.

49. Which of the following are elements of the charge, Hit and Run, Section 236(1) C.C.?

a) involved in an accident with any other object
b) having regard to all the circumstances
c) causes bodily harm to any other person
*d) is involved in an accident with a vehicle
*e) fails to offer assistance where any person has been injured or appears to require assistance

50. A motorist collides with a parked car on a privately owned lot and leaves the scene. You later apprehend him at his home. What should you do?

a) Arrest him for Hit and Run.
b) Issue an Appearance Notice for Hit and Run.
*c) Demand an explanation for why he left the scene.
d) You have no powers in this instance because the accident happened on private property.

51. In order to lay a charge of Operating a Motor Vehicle While Disqualified,

a) the disqualification must have occurred in Alberta.
b) The disqualification must have occurred as a result of a criminal code violation.
c) there should not be any other, more important charges pending against the suspect.
*d) the vehicle must be being operated on public property.
*e) the vehicle must be in motion.

52. Mandatory disqualification will follow a conviction for which of the following?

a) Dangerous Operation Causing Death
b) Driving While Disqualified
c) Careless Driving, H.T.A.
*d) Operate While Impaired
*e) Operate While Over 80 mg. alcohol in blood
f) Hit and Run
*g) Refusal to provide a breath sample

Questionnaire

Directions

A. Answer the questions on the following questionnaire.

B. Tear off the blank back sheet with your name on it. This will ensure the confidentiality of your answers.

C. Return the questionnaire to William Wosar, Training Section.

Over the past four months you completed a training program consisting of eight DIIT lessons and 8, 4, 2, or 1 lesson tests. Please answer the following questions in terms of your opinions about this training program. The pre-test and post-test were not part of the training program, so disregard them when answering the questions. We are only interested in your opinions about the eight lessons and their test(s).

1. Which PLATO Group were you in?

IMM118 ______
IMM124 ______
IMM132 ______
IMM141 ______
DEL218 ______
DEL224 ______
DEL232 ______
DEL241 ______

2. In my opinion the testing was conducted

______ too frequently
______ about right
______ not frequently enough

3. I felt the tests were

______ too long
______ about the right length
______ too short

4. The feedback I received on the lesson test(s) was

_____ very useful
_____ somewhat useful
_____ not useful

5. Overall the quality of the lessons was

_____ Excellent
_____ Good
_____ Satisfactory
_____ Poor
_____ Very Poor

6. Do you think the lessons helped you do better on the tests?

_____ Yes _____ No

7. Do you think that computer-based training is an effective way to learn?

_____ Yes _____ No

8. Do you enjoy learning this way?

_____ Yes _____ No

9. Before this training program, did you normally do the introductory lessons?

_____ Yes _____ Sometimes _____ No

10. Will you do the introductory lessons from now on?

_____ Yes _____ Probably _____ No

11. Please add any comments you would like to make.